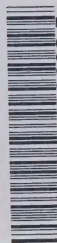




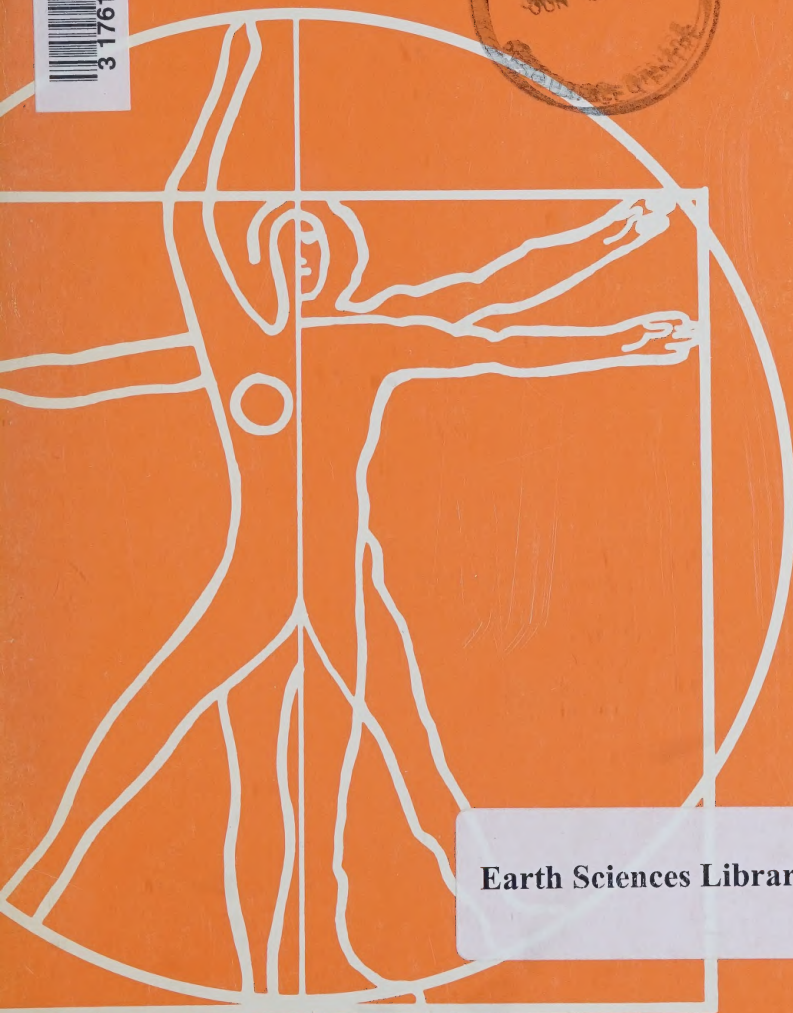
CA1 HW1182 E80

82-EHD-80

tap water consumption in Canada



3 1761 05688638 5



Earth Sciences Library



Digitized by the Internet Archive
in 2025 with funding from
University of Toronto

<https://archive.org/details/31761056886385>



TAPWATER CONSUMPTION IN CANADA

Environmental Health Directorate
Health Protection Branch

Published by authority of the
Minister of National Health and Welfare

November 1981

COPIES OF THIS REPORT CAN BE OBTAINED FROM:

Public Affairs Directorate,
Department of National Health and Welfare,
Brooke Claxton Building, 5th Floor,
Ottawa K1A 0K9

Également disponible en français sous le titre
"Consommation de l'eau du robinet au Canada"

ACKNOWLEDGEMENTS

This document was prepared by the following authors:

Dr. V.C. Armstrong

Monitoring and Criteria Division
Bureau of Chemical Hazards
Environmental Health Directorate

Dr. M.G. Holliday
Mr. T.F. Schrecker

Michael Holliday and Associates
Ottawa

and is based on the results of a national survey conducted by Canadian Inter-Mark on behalf of the Environmental Health Directorate.

Acknowledgement is also made to Dr. R.S. McCullough who, as Chief, Statistics and Data Processing Division, Environmental Health Directorate, was involved in the design of the survey and also conducted a preliminary analysis of the data.

The graphics for the report were designed and prepared by Mr. Chris Jarrett, Ottawa. Word processing and layout were undertaken by Thomas Typing Service, Nepean.

SYNOPSIS

The report presents results of a survey of the consumption of tapwater and tapwater-based beverages by Canadians. The survey was conducted in two phases -- late summer 1977 and winter 1978 -- and involved 970 individuals from 295 households. Interview and questionnaire techniques were used to determine the per capita consumption of tapwater in all beverage forms, the apportionment of consumed tapwater among various beverages (water, tea, coffee, reconstituted milk, soft drinks, homemade alcoholic beverages, etc.), and to elicit information on individual habits and other factors which can influence the quality of water consumed from the tap. In the report, the patterns of consumption are analyzed with respect to age, sex, season, geographical location and physical activity. Also included are survey results which indicate the extent of use of water softeners and other point-of-use water treatment devices in Canada.

For the population as a whole, the average consumption of tapwater and tapwater-based beverages is 1.34 L/capita.day; 90 percent of the population sampled consume less than 2.36 L/capita.day. Tapwater consumption increases with age, with the most rapid rate of change occurring in individuals less than 18 years old. Little difference in per capita consumption between the sexes is observed. When tapwater intake is considered on a volume per unit body-weight basis, it is found that children aged five years and under consume approximately twice as much as the older groups and women's daily intake is some 20 percent higher than men's. The relevance of overall daily consumption and consumption measured on a body-weight basis to the setting of water-quality guidelines is briefly discussed.

A breakdown of the use to which tapwater is put for drinking purposes shows that while consumption of "raw" tapwater remains fairly constant among individuals aged six years and above, the increase in tapwater consumption for all beverages with age appears due entirely to the rapid growth in consumption of tea and coffee among those aged 18 years and over,

which more than offsets the decrease in consumption of other non-alcoholic tapwater-based beverages in the adult population. There is little difference in overall consumption of tapwater and tapwater-based beverages between the summer and winter phases of the survey, but consumption of cold tapwater-based beverages is higher in summer and consumption of soup and other hot tapwater-based beverages is higher in winter. Overall tapwater consumption by adults tends to be higher among those who consider themselves to be physically active than among those who do not.

The majority of Canadians usually flush the tap before using the water and when questioned about the use of the hot-water tap for making hot beverages the majority of Canadian homemakers said they seldom or never used the hot-water tap. For Canada as a whole, some 8.5 percent of households have water softeners and 3.7 percent have water purifiers.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
SYNOPSIS	iii
LIST OF FIGURES	vi
LIST OF TABLES	vii
1. INTRODUCTION	1
1.1 Reasons for Carrying Out the Study	1
1.2 Factors Affecting Exposure to Contaminants	3
1.2.1 Amount Consumed	
1.2.2 Water-Use Habits	
1.3 The Survey	6
1.3.1 Survey Methodology	
1.3.2 Assessments of Amount of Tapwater Consumed	
1.3.3 Representativeness of the Sample	
2. SURVEY DATA	13
2.1 Overall Tapwater Consumption	13
2.2 Use of Tapwater by Beverage Consumed	22
2.3 Other Consumer Habits and Preferences	26
3. COMMENTS, COMPARISONS AND CONCLUSIONS	31
3.1 Two Litres per Capita per Day?	31
3.1.1 Consumption on a Volume per Unit-Body-Weight Basis	
3.1.2 The Climate Factor	
3.1.3 Tapwater Consumption and Total Fluid Intake	
3.2 Comparative Results	35
3.2.1 Total Tapwater Consumption in Canada and Elsewhere	
3.2.2 Beverages Made from Tapwater	

3.3	Miscellany	39
3.3.1	Water-Softener Use	
3.3.2	Tap Flushing and Hot-Water Use	
3.4	Concluding Remarks	41
4.	REFERENCES	43
APPENDIX I	Household Information Questionnaire	47
APPENDIX II	Homemaker Questionnaire	53
APPENDIX III	Individual Diaries of Water Consumption	57
APPENDIX IV	Reference Tables	67

LIST OF FIGURES

FIGURE 1	Total Tapwater Consumption: by age, combined seasons. a) Both Sexes b) Females c) Males	14
FIGURE 2	Frequency Distribution of Tapwater Amounts Drunk Within the Whole Population	18
FIGURE 3	Frequency Distribution of Tapwater Consumption: by age grouping. a) Adults b) School Children c) Preschoolers	19
FIGURE 4	Cumulative Frequency Distribution of Tapwater Consumption: by age grouping. a) Adults b) School Children c) Preschoolers	19
FIGURE 5	Tapwater Consumption: by region	21
FIGURE 6	Tapwater Consumption: by level of activity	21
FIGURE 7	Distribution of Tapwater Consumption Among the Different Beverages: by age group, both sexes and seasons	23
FIGURE 8	Seasonal Variation of Beverage Consumption: total population	25

LIST OF TABLES

TABLE 1	Population Representation by Age Group	10
TABLE 2	Regional Representation	10
TABLE 3	Household Representation by Community Size	11
TABLE 4	Household Representation by Dwelling Type	11
TABLE 5	Apportionment of Tapwater Consumption among Various Beverages by Region (Summer only)	27
TABLE 6	Running Tap Before Using Water for Beverages (Homemakers)	28
TABLE 7	Tap-Flushing Habits (Individuals)	28
TABLE 8	Homemakers' Use of Hot Tap for Hot Beverages	29
TABLE 9	Types of Water Piping	29
TABLE 10	Average Body Weight of Canadians for 1978-79: by age group and sex	33
TABLE 11	Average Daily Tapwater Intake of Canadians: expressed as millilitres per kilogram-body-weight	33
TABLE 12	Average Daily Tapwater Consumption in Different Countries	36
TABLE 13	Average Daily per Capita Consumption of Tea and Coffee in a Number of Countries	38
I	Average Daily Tapwater Consumption and Ranges for Both Sexes Combined: by age, combined seasons	69
II	Average Daily Tapwater Consumption and Ranges for Females: by age, combined seasons	69
III	Average Daily Tapwater Consumption and Ranges for Males: by age, combined seasons	70
IV	Average Daily Tapwater Consumption and Ranges: by age groupings, both sexes, combined seasons	70
V	Daily Consumption Distribution by Age Group (500 mL Increments): both sexes, combined seasons	71

VI	Daily Consumption Distribution by Age Group (Approx. 200 mL Increments): both sexes, combined seasons	72
VII	Daily Consumption Distribution by Age Group (Approx. 200 mL Increments): by sex, combined seasons	73
VIII	Average Daily Tapwater Consumption: by age, by season	74
IX	Average Daily Tapwater Consumption in Relation to Region of Canada: all ages, both sexes	74
X	Average Daily Tapwater Consumption as a Function of Physical Activity at Work and in Spare Time: 16 years and older, combined seasons	75
XI	Average Daily Tapwater Consumption Apportioned Among Various Beverages: both sexes, by age, combined seasons	76
XII	Females -- Average Daily Tapwater Consumption Apportioned Among Various Beverages: by age; combined seasons	77
XIII	Males -- Average Daily Tapwater Consumption Apportioned Among Various Beverages: by age; combined seasons	77
XIV	Average Daily Tapwater Consumption Apportioned Among Various Beverages: respondents aged 18 and over; by season	78
XV	Average Volume of Tapwater Consumed Among Hot and Cold Beverages: by age, both sexes, combined seasons	79
XVI	Average Volume of Tapwater Consumed Among Hot and Cold Beverages: by age, by sex, combined seasons	79
XVII	Use of Hot Tapwater for Making Hot Beverages: by household (homemaker's custom), both seasons	80
XVIII	Distribution of Piping Material Among Households	80
XIX	Average Daily Tapwater Consumption in Relation to Community Size: all ages, both sexes, combined seasons	81
XX	Average Daily Tapwater Consumption by Source of Water Supply: all ages, both sexes, combined seasons	81

XXI	Average Daily Tapwater Consumption by Satisfaction with Water Supply: combined seasons	82
XXII	Percentage of Daily Tapwater Consumption Taken in "Raw Form" by Satisfaction with Water Supply: summer	82
XXIII	Percentage of Households Having Water Softeners and/or Water Purifiers: by region	83
XXIV	Use of Water Softeners and Purifiers Nationwide	83

1. INTRODUCTION

The purpose of this report is to present and discuss results of the first comprehensive investigation of tapwater consumption in Canada, a study which was carried out by Canadian Inter-Mark* in 1977 and 1978 for the Environmental Health Directorate of the Department of National Health and Welfare. The study provided not only basic information on the amounts of tapwater and tapwater-based fluids consumed but also examined the tendency of Canadians to flush taps before using the water, how consumption of tapwater-based beverages changes with age and even geographic location, how the activity level of our lives affects the amounts of water consumed, and whether Canadians consume more water in summer than in winter.

1.1 REASONS FOR CARRYING OUT THE STUDY

Several countries and international organizations, including Canada, the United States, the World Health Organization, the North Atlantic Treaty Organization and the European Economic Community, periodically undertake appraisals of factors which can affect the safety and palatability of drinking water supplies. Re-assessment of standards or guidelines for drinking water quality is important in helping ensure the continuing provision of wholesome supplies as water treatment technologies and environmental factors change. The soundness of recommendations for maximum acceptable concentrations of potentially hazardous contaminants in drinking water depends, in part, on knowing the contribution made by drinking water to an individual's total exposure to contaminants from all possible sources. This in turn requires knowing the amounts of tapwater which people consume. Knowledge of the volume of tapwater and tapwater-based fluids consumed by

* Canadian Inter-Mark
(a division of Canadian International Marketing Information Ltd.)
301 Donlands Avenue
Toronto, Ontario
M4J 3R8

children is also required to estimate the concentrations of fluoride which should be maintained as a prophylactic measure against tooth decay.

Recommendations for the maximum acceptable concentrations (MAC) of parameters used to judge water quality in Canada have been published as Guidelines for Canadian Drinking Water Quality - 1978.¹ These concentrations, considered the maximum levels acceptable from the standpoint of maintaining good health, were derived assuming an individual's average daily consumption of tapwater and tapwater-based fluids to be two litres. The present study was undertaken, in part, to establish the appropriateness of this assumption, and to discover whether fluctuations occur because of dwelling location, age, sex and satisfaction with the quality of tapwater.

Similar surveys have been conducted in the Netherlands² and the United Kingdom.³ The Dutch study, carried out in 1976, gathered data on the volumes of tapwater individually consumed and on the tapwater-usage habits of consumers (e.g., whether taps are flushed before the water is used and whether cold- or hot-water systems are used for specific applications). This investigation, designed to provide information pertinent to the assessment of human exposure to metals and minerals from tapwater consumption, involved a survey of 1472 households comprising 4620 individuals. The British survey, carried out in 1978, studied the drinking habits of 3564 individuals in 1320 households. It accounted for total fluid consumption and was not limited just to tapwater and tapwater-based drinks. Questions elicited information on: type and quantity of drinks consumed; factors affecting the volume and type of drink consumed (e.g., age, sex, socio-economic group); place of consumption (at home or elsewhere); difference between consumption during the week and at weekends; and water- usage patterns.

1.2 FACTORS AFFECTING EXPOSURE TO CONTAMINANTS

An individual's exposure to contaminants from tapwater is affected by a variety of factors. The quality of the raw-water source, the chemicals used to disinfect and condition the drinking water, and the type and quality of the distribution system will all affect the quantity and type of contaminant entering a household's plumbing system. Dissolution of metals from pipes and taps in the home may increase pollutant levels before the water is drunk. And finally, of course, exposure will depend on the volume of tapwater consumed.

1.2.1. Amount Consumed

An individual's daily fluid requirements (of which tapwater and tapwater-based beverages make up a substantial part) will vary widely. Such factors as age (and possibly sex), body weight, temperature of the ambient air, physical activity, and state of health will all contribute. On the basis of data presented in a number of physiology texts, it appears that in temperate climates and under ordinary circumstances the average adult requires from about two to four or five litres of water daily. This requirement may be fulfilled by ingestion of fluids (1 to 2.5 L/day), ingestion of water present in solid and semi-solid foods (0.7 to 1.5 L/day), and from water formed within the body as a result of metabolic oxidation of foods (0.2 to 0.4 L/day).⁴⁻¹²

An increase in the volume of fluids consumed would be expected as children grow older, and this effect has indeed been demonstrated. Galagan et al. have shown, in a study of children ranging in age from under one to 10 years, that the total fluid (and inter alia, tapwater) consumption increased with age.¹³ But, significantly, the amount consumed per pound body weight decreased with age.

Climatic conditions would also be expected to have an impact on an individual's fluid intake. In an extreme example, it has been shown that the mean consumption of fluids by men in desert regions is some 80 percent higher than that for those living in the tropics.¹⁴ Children residing in areas where the mean annual temperature is 21°C (70°F) have been found to consume about twice as much water as those living in areas where the mean temperature is 10°C (50°F).¹⁵ In another study, Galagan et al. demonstrated that in a sample of 455 infants and children, whose ages ranged from one to 10 years, tapwater consumption increased directly with increasing temperature over the range 10°C (50°F) to 38°C (100°F).¹³

The connection between physical activity and fluid consumption is obvious, and arises from the body's need to replace water lost through sweating. "Even under temperate environmental conditions, men performing physical work may have to evaporate a pint or more of sweat per hour to dissipate the excessive metabolic heat produced during hard work."¹⁶ And, for more extreme situations, it has been demonstrated that men participating in 20-mile runs incurred sweat losses ranging from 1.5 to 4.2 litres, even though air temperatures were a relatively cool 15 to 16°C (about 60°F).¹⁷

All these factors, which would lead to increased fluid intake, are a result of the physiological need to maintain the body's water balance. Tapwater and tapwater based fluids will be one source of the replacement water.

1.2.2 Water- Use Habits

As already mentioned, it is not sufficient to consider merely the amount of tapwater consumed by an individual when assessing exposure to tapwater contaminants. Corrosion of the distribution and household plumbing contributes to the metal content of drinking water; leaching of plastics additives (plasticizers, hardeners, and so on) may contribute organic pollutants. The hardness of the water supply can have a bearing upon the amount of

corrosion experienced, with hard waters generally being less corrosive than soft waters.¹⁸ (This may not always be the case; one Dutch study found that hard water from a particular location was more corrosive than softer water obtained from another location in Holland.²)

Water-softening systems are installed in some households having a hard-water supply. The usual reasons for such installations are to reduce scaling in pipes and water heaters of the household's hot-water system and to make laundering easier. There are two possible health considerations associated with water-softener use. First, water-softener ion-exchange resins release sodium ions when absorbing cations from the hard water. Hence tapwater from water-softened household systems will probably contain elevated sodium levels, a factor which might be an important consideration to persons on low-salt diets. Second, there is some epidemiological evidence to indicate that the incidence of heart disease is higher in communities in soft-water areas than in hard-water areas.²¹ There is no consensus on why this should be so, and two schools of thought exist; one suggests that the metal ions present in hard water (calcium, magnesium) have a protective effect on heart muscle,²¹ and the other suggests that heavy-metal ions (e.g., cadmium, antimony) leached from household plumbing by the normally more corrosive soft water exert a cardiotoxic effect.²²

The length of time water stands in pipes will influence contaminant concentrations. A United States study compared metal-ion concentrations in samples obtained from household taps after water had stood in the system overnight with the concentrations found in samples taken after the system had been flushed by allowing the taps to run for a sufficient period of time.¹⁹ In Seattle, which has a soft-water supply with a comparatively low pH (i.e., a potentially corrosive supply), concentrations of the monitored pollutants (Cd, Cu, Fe, Pb, Mn, Zn) were considerably higher (by an average of 200 to 800 percent) in the overnight samples than in samples obtained after the systems had been flushed. Very much smaller

concentration increases were found when the same investigation was carried out in Boston which has somewhat harder water (although still considered soft), and a more neutral pH (i.e., probably a somewhat less corrosive water). Similarly elevated levels of lead (the only element analyzed) have been found in Victoria, B.C., tapwater which had stood in lead or copper pipes for 24 hours. The presence of lead in samples from copper piping was attributed to the solder used in the plumbing.²⁰

The rate of dissolution and, indeed, the solubilities of contaminants would normally be higher at elevated temperatures. So, for a given use pattern, contaminant levels could be higher in water from the hot tap than from the cold.

1.3 THE SURVEY

The objectives of the survey can be divided into three general areas:

- 1) To determine the quantities of tapwater consumed in all forms and to analyze variations in respect of age, sex, season, geographic region and physical activity.
- 2) To determine the apportionment of the total volume of tapwater consumed among various beverages (water, tea, coffee, reconstituted milk, soft drinks made from powders, soup, ice, popsicles, homemade beer and wine, etc.) and to analyze the data in regard to age, sex, geographic region and season.
- 3) To examine consumer habits with regard to factors which affect the quality of water, such as running the tap before water use, selecting the tap from which drinking water is taken, plumbing materials and use of water-treatment devices.

1.3.1 Survey Methodology

The method chosen to carry out the study involved surveying a representative sample of the Canadian population. The sample was based on area probability sampling and relied on the 1971 Canadian census format. Since drinking water intake may vary seasonally, summer and winter phases of the survey were carried out. Interviewers were given a quota of three to five households per selected area during the summer of 1977, and were instructed to contact household heads (female or male) asking for the co-operation of every household member in monitoring water consumption for a two-day period (one weekday, one weekend day) in the summer and, similarly, a two-day period in the winter. The first, and summer, part of the survey was conducted in August/September 1977 while the second, and winter, part was conducted in January/February 1978.

For the first part of the survey, a Householder Information Questionnaire (Appendix I) was administered by the interviewer who then left the following materials at the home:

1. A letter from Canadian Inter-Mark explaining the study.
2. A self-administered Homemaker Questionnaire (Appendix II).
3. An individual diary of water consumption to be filled in by each member of the household (Appendix III).

Approximately one week later, the interviewer returned to pick up the completed questionnaires. Only item 3, the individual diary of water consumption, was used for the winter survey. A number of additional questions, however, were included in the winter version of the individual diary (see Appendix III) to clarify information on a household's plumbing system and to elicit information on the physical activity of individuals aged 16 years and over. Again, the completed diaries were collected about one week later. Altogether, the interviewers made at least four contacts with each household.

The summer sample comprised 342 households and 1155 individuals, while the winter sample comprised 295 households and 970 individuals -- 17 percent of the summer sample being lost over the intervening six months. In this report, results are given only for those persons who were available for both phases of the survey, except where noted.

1.3.2 Assessment of Amounts of Tapwater Consumed

To measure the actual quantity of fluids consumed, the respondents were asked to identify the beverage container they used for each drink which was closest to the following:

1 cup	= 5.0 ounces of water
1 mug	= 8.0 ounces of water
1 small glass*	= 4.0 ounces of water
1 medium glass*	= 6.5 ounces of water
1 large glass*	= 9.0 ounces of water
1 sip of water	= 1.0 ounces of water
1 drink with ice cube or water added	= 1.5 ounces of water
1 bowl of soup	= 4.5 ounces of water
1 homemade popsicle	= 3.0 ounces of water
1 8-oz. bottle of baby formula or juice	= 4.0 ounces of water
1 4-oz. bottle of baby formula or juice	= 2.0 ounces of water
1 4-oz. bottle of water	= 4.0 ounces of water

A conversion factor of 0.0284 was used to convert ounces to litres.

* The questionnaires (Appendix III) included a pictorial guide to aid in classifying the sizes of vessels used.

1.3.3 Representativeness of the Sample

As a check on the validity of the sample, the percentages of individuals and households surveyed can be compared to those provided by census data. This is done for population, regional and community-size representations in Tables 1 to 4. Although there are slight discrepancies -- age groups 6-17 years and 35-54 years and Quebec are slightly over-represented, while the 18-34 years group and British Columbia are slightly under-represented -- the sample reflects Canadian demography remarkably well, especially since the sample size is comparatively small. These discrepancies are most unlikely to have any effect upon the validity of the survey's results. The smallness of the sample, however, indicates caution in ascribing too deep a significance to relations which emerge, especially in instances where the sizes of the subsets are small.

The one respect in which the sample is not closely representative of the general population involves its over-representation of residents of single, detached houses and under-representation of apartment dwellers, as shown in Table 4. It is not clear what effect this skewing of the sample may have had on data on consumption patterns, but subsequent surveys should probably make a point of securing a sample more representative of the population in terms of dwelling type.

TABLE 1 Population Representation by Age Group

<u>Age Group</u>	<u>Both Sexes</u>		<u>Females</u>		<u>Males</u>	
	<u>Survey</u>	<u>Census*</u>	<u>Survey</u>	<u>Census*</u>	<u>Survey</u>	<u>Census*</u>
<3	3.5%	4.5%	4.0%	4.4%	3.0%	4.7%
3-5	4.8	4.5	5.2	4.3	4.5	4.6
6-17	25.8	22.1	24.9	21.5	26.8	22.8
18-34	23.9	29.5	25.0	29.2	22.7	29.8
35-54	26.1	22.0	26.2	21.8	26.1	22.1
55+	15.7	17.4	14.7	18.8	16.9	16.0

* Statistics Canada - 1977 Postcensus Estimates

TABLE 2 Regional Representation

<u>Region</u>	<u>Individuals</u>		<u>Households</u>	
	<u>Survey</u>	<u>Census*</u>	<u>Survey</u>	<u>Census**</u>
Maritimes	8.4%	9.5%	9.5%	8.1%
Quebec	31.6	27.1	30.8	26.4
Ontario	37.8	36.0	36.3	37.9
Prairies	14.0	16.7	15.3	16.1
British Columbia	8.2	10.8	8.1	11.0

* Statistics Canada - 1977 Postcensus Estimates

** Statistics Canada - 1976 Census

TABLE 3 Household Representation by Community Size

<u>Community Size</u>	<u>Percent Households</u>	
	<u>Survey</u>	<u>1976 Census</u>
over 500,000	31.4	34.4
100,000-500,000	18.6	16.3
30,000-100,000	8.1	8.9
10,000- 30,000	6.8	7.8
urban<10,000	9.8	11.2
rural	24.8	21.4

TABLE 4 Household Representation by Dwelling Type

<u>Dwelling Type</u>	<u>Percent Households</u>	
	<u>Survey</u>	<u>Canada, 1977*</u>
Single detached	80.7**	59.2
Single attached	6.1	7.8
Apartment (incl. duplex)	13.2	32.9

* Ontario Statistics, 1979

** Including 3.1% mobile homes

2. SURVEY DATA

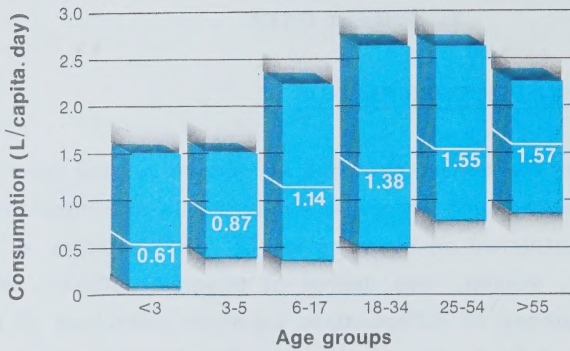
2.1 OVERALL TAPWATER CONSUMPTION

This section of the report provides an account of the total amount of tapwater and tapwater-based beverages consumed by individuals in Canada, and examines the influence on consumption of such variables as age, sex, geographic location, season, and degree of physical activity. No attempt was made in the survey to differentiate tapwater consumed at home from that consumed away from the home. Because of the wide range in volumes of tapwater intake recorded and the relatively small size of the sample, there are limits to the reliability of relationships that emerge and to the precision of numerical results. The emphasis here, and in the following two sections, is therefore on a generalized approach and on the more pronounced trends that do emerge from the data.

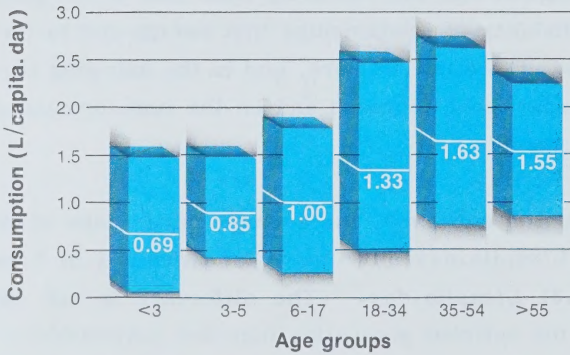
For the populations surveyed, the average daily intake of tapwater in all forms was 1.34 L/capita.day. The value for males is 1.37 L/capita.day, and for females 1.31 L/capita.day. (The difference is not significant.) However, because the sampled population included individuals of all ages, there are limits to the usefulness of an average daily intake value for the entire population. Figure 1 therefore shows the survey data broken down by age groups: Figure 1a for the entire population, Figure 1b for females and Figure 1c for males. (Data on which these Figures are based are provided in Reference Tables I-III.)

A brief explanation of these Figures is in order. They are in a bar-graph format, with each age group represented by one bar. The solid white line across each bar represents the average daily tapwater intake recorded for that age group. Thus, the average intake recorded for all those surveyed in the age group 6-17 was 1.14 L/capita.day (Figure 1a); for females age 6-17 the figure was 1.00 L/capita.day (Figure 1b), and for males age 6-17 it was 1.27 L/capita.day (Figure 1c).

A.
males and
females



B.
females



C.
males

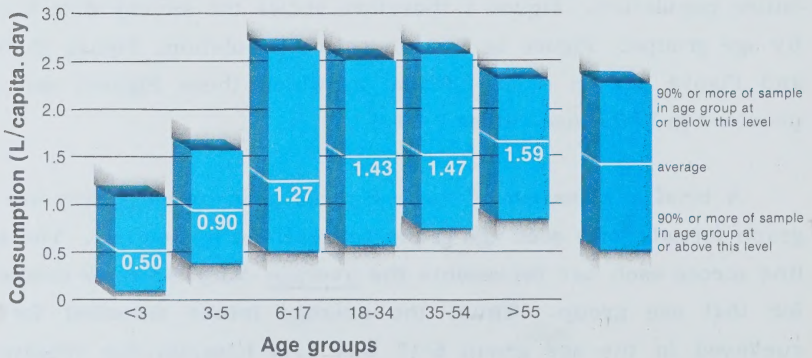


FIGURE 1 Total Tapwater Consumption: by age, combined seasons

Each bar contains a coloured area. Within each age group, the average tapwater intake of 90 percent or more of the population falls below the level corresponding to the upper limit of the coloured area. Thus, using the same examples again, the average daily intake of 90 percent or more of the entire population in the 6-17 age group is below 2.21 L/capita.day; for females the value is 1.79 L/capita.day, and for males it is 2.64 L/capita.day.

The statement about "90 percent or more" of the population may seem unnecessarily vague. However, it is impossible to consistently obtain exact decile limits for all age groups for the reason stated in the footnotes to Reference Tables I-IV, so this method of showing ranges is adopted throughout the report.

The lower limit of the coloured area within each bar indicates a level of tapwater consumption exceeded by 90 percent or more of the population. Using the same example once again, the tapwater intake of 90 percent or more of the population in the age group 6-17 is greater than 0.36 L/capita.day; for females, the corresponding value is 0.36 L/capita.day as well, and for males it is 0.50 L/capita.day.

As one might expect, because individuals are growing rapidly between 0 and 18 years of age, tapwater intake rises sharply during this period. After age 18, tapwater intake rises much more slowly, but consistently, over the remainder of an individual's lifetime. This can be seen in the average daily intake figures, and as well in the tendency of the lower limit of the coloured areas (the level of tapwater intake exceeded by 90 percent or more of the population) to rise with age.

One should not take the figure of 18 years too literally; it may be that the point at which tapwater intake levels out, depending on the individual, is 16, or 19, or 20. But the general trend is to a rapid rise in tapwater intake up until an age somewhere in that general range (essentially the age of completion or near-completion of physical development) followed by a much slower but continuing rise.

Interestingly, the level of tapwater consumption which is exceeded by 10 percent or less of the population -- which might be a more appropriate figure for some standard-setting applications -- does not appear to rise among age groups of 18 years of age and over.

Within age groups, two possibly important variations in consumption by sex are observed. In the under-3 age group, females appear to consume more water than males both on average and in terms of the level of tapwater consumption exceeded by 10 percent or less of the population (1.50 L/capita.day versus 1.07 L/capita.day). In the 6-17 age group, males consume more tapwater than females, again on average and in terms of the level of tapwater consumption exceeded by 10 percent or less of the population (2.64 L/capita.day for males, as against 1.79 L/capita.day for females).

The difference in reported daily tapwater intake by season is not a major one (Reference Table VIII); in fact, summer and winter averages for the whole population are essentially the same (1.31 L/capita.day in summer and 1.37 L/capita.day in winter). Taking into account only the "adult" (18 years of age and over) age groups, average daily tapwater consumption in summer is 1.45 L/capita.day, and in winter 1.53 L/capita.day. This observation should be viewed in light of the caveat about the seasonal data in the survey noted in Section 3.1.2. Additionally, some differences in the apportionment of tapwater intake among various beverages are observed, and are discussed in Section 2.2 below.

The age groups into which the survey data were originally divided can be combined into three larger groupings -- age 5 and under, age 6-17, and age 18 and over -- corresponding roughly to pre-school children, school age children and young adults, and adults. The first two of these groupings -- especially the 6-17 grouping -- are quite heterogeneous, but the groupings are useful for many purposes. Reference Table IV shows the same data as shown in Reference Tables I-III (and Figure 1), but aggregated into these broader groupings.

These groupings are adopted for the next set of Figures, which document the frequency with which various daily intakes of tapwater were observed. In Figure 2, which is based on data presented in Reference Table V, the larger bars indicate the percentage of the total sample reporting daily tapwater intakes within given 500-mL ranges. So, 32.2 percent of the total sample (all age groups) report tapwater consumption in the range 1.0 to 1.5 L/day.

The smaller bars within each of these ranges indicate the age breakdown of the portion of the total sample reporting daily tapwater intakes in the range in question. So, for instance, we can see that most of the individuals reporting tapwater intakes in the range 1.5 to 2.0 L/day were 18 or older; this group (those aged 18 or over reporting drinking water intakes in the range of 1.5 to 2.0 L/day) accounted for 13.1 percent of the total sampled population.

This Figure illustrates that not only averages, but also frequency distributions can be misleading when a highly heterogeneous population is involved, since the range of reported values that represents the "peak" of the frequency distribution may contain very few representatives of some groups within the population. This is the case, for example, with the most frequently reported range of values for tapwater intake (1.0 to 1.5 L/day), which contains very few individuals in the 5-and-under age grouping.

To provide a finer breakdown of the frequency distribution of reported daily tapwater intakes in each age grouping, Figure 3 illustrates the frequency distribution of reported average daily tapwater intake for each of the three age groupings separately, but broken down into increments of approximately 200 mL/capita.day, rather than 500 mL/capita.day. (The reason for the approximation in the case of the smaller increments is that the data were originally tabulated on a weekly basis, and hence cannot be converted precisely to even increments of daily tapwater consumption without complete retabulation of the original data.) It is interesting to note

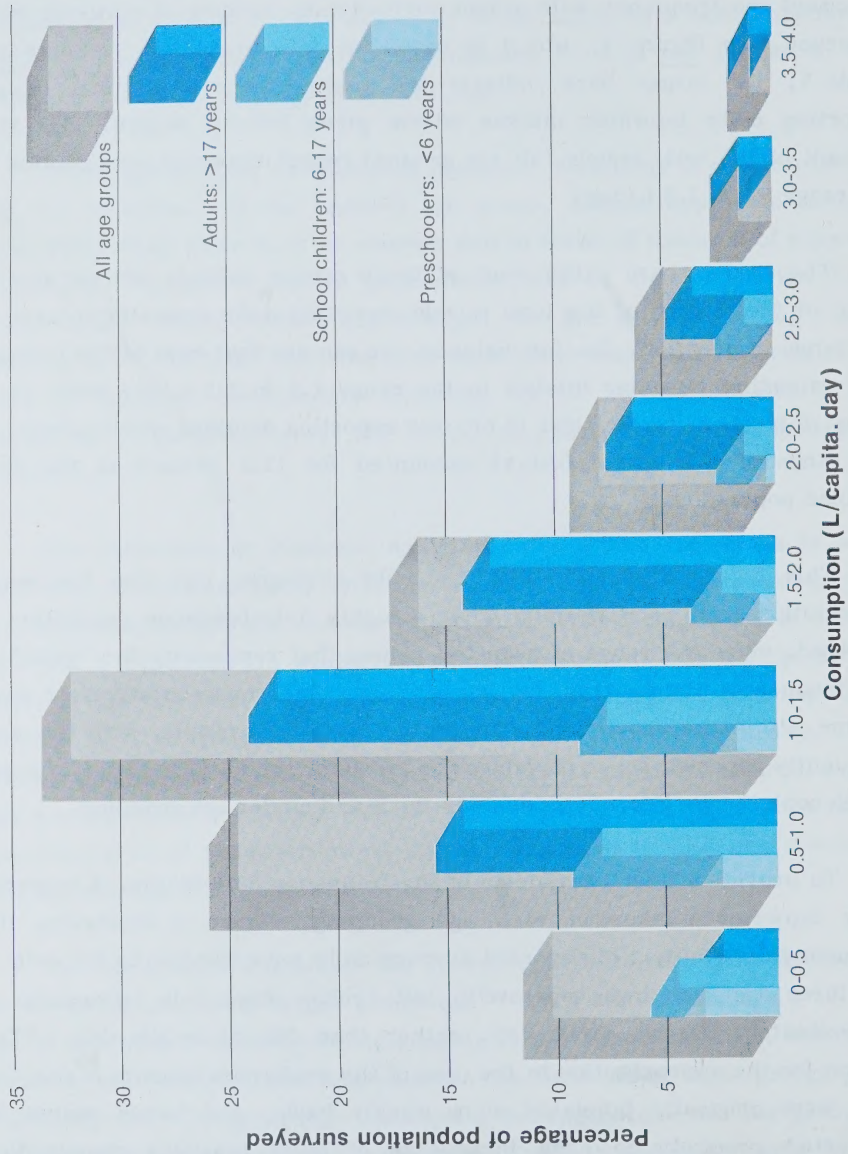
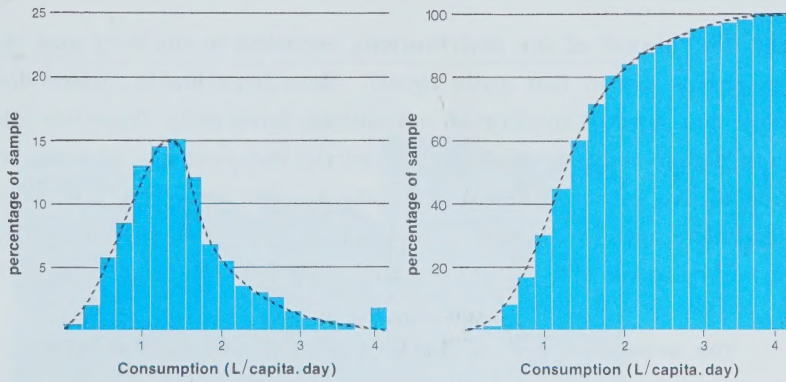
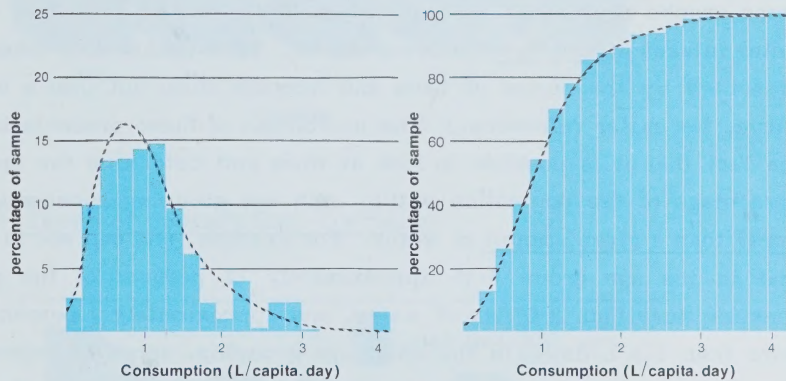


FIGURE 2 Frequency Distribution of Tapwater Amounts Drunk Within the Whole Population

A.
Adults



B.
School children



C.
Preschoolers

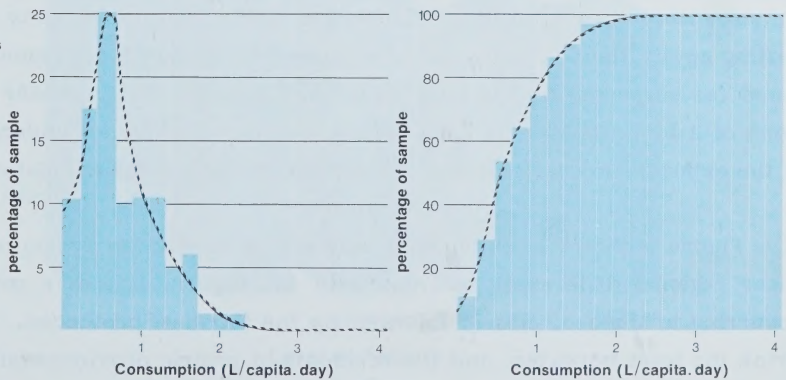


FIGURE 3 Frequency Distribution of Tapwater Consumption: by age grouping

FIGURE 4 Cumulative Frequency Distribution of Tapwater Consumption: by age grouping

that the "peaks" of the distributions reported in the 6-17 and 18-and-over age groups are in fact quite broad. More importantly, these distributions show that a small number of individuals have daily tapwater intakes very much higher than would be indicated by the averages or even by the high ends of the coloured areas in Figure 1. For instance, 1.6 percent of the population aged 6-17 and 2 percent of those 18 and over report daily tapwater intakes of 3.9 litres or above. (See also Reference Table VI.)

The same data are shown in a slightly different fashion in Figure 4, which represents cumulative frequency distributions. That is, each bar in these graphs represents the percentage of the sample reporting daily tapwater intakes at or below the level shown. (The dashed line takes the data presented by the series of bars and smooths them out into a continuous curve, for easier reference.) The usefulness of these presentations lies in the fact that it is possible to look at them and determine the approximate percentage of the population within each age grouping consuming less (or more) than a given amount of water. For example, one can see in Figure 4b that in the age group 6-17 approximately 12 percent of the population consume more than 2 L/day of water, and approximately 7 percent consume more than 2.5 L/day. In the adult age grouping, about 18 percent of the population consume more than 2 L/day of tapwater, and about 9 percent consume more than 2.5 L/day. These are useful figures for many standard-setting applications. However, as explained in Section 3.1, it should also be noted (as suggested by the long "tails" in Figure 3) that tapwater consumptions of 2 L/capita.day or 2.5 L/capita.day may involve an underestimation of the exposure to contaminants of a certain fraction of the population.

Figure 5 shows average daily tapwater consumed by region of Canada. Clear regional differences emerge, with the highest tapwater consumption occurring in Quebec, closely followed by the Maritime provinces. Ontarians drink the least tapwater, and the residents of prairie provinces only slightly more. The pattern of these differences is fairly consistent across seasons.

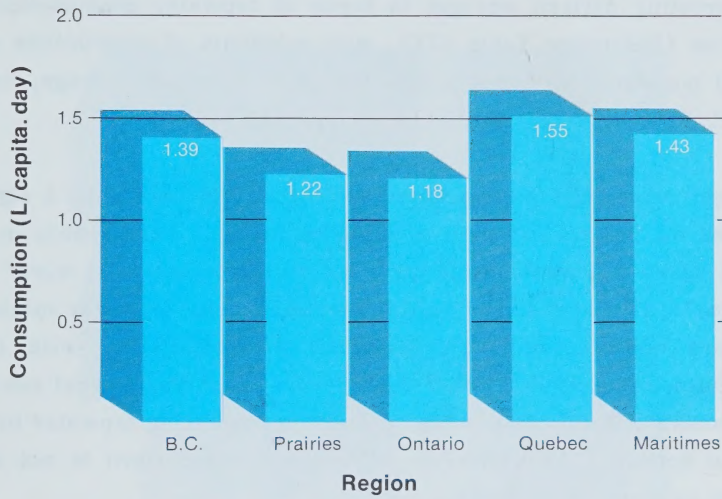


FIGURE 5 Tapwater Consumption: by region

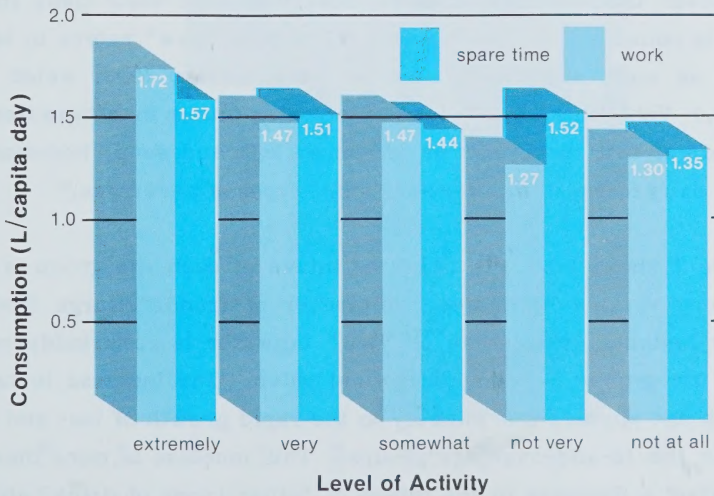


FIGURE 6 Tapwater Consumption: by level of activity

An interesting pattern emerges in terms of tapwater consumption by community size (Reference Table XIX), with residents of communities with over 500,000 population consuming less tapwater than the average, as do (less markedly) people in communities of less than 10,000.

One might reasonably expect that physical activity would be a significant influence on the consumption of drinking water. Participants in the survey were asked to rate their physical activity separately "at work" and "in spare time". Figure 6 shows how the average daily tapwater intake of those members of the population 16 years or older varies with their (admittedly subjective) evaluation of their levels of activity. What emerges is a fairly consistent (and predictable) pattern of increasing tapwater intake with physical activity. One possible reason that the pattern is not more pronounced is explored in Section 3.1.2.

2.2 USE OF TAPWATER BY BEVERAGE CONSUMED

Whatever the age of Canadians, less than half their daily intake of tapwater is consumed in "raw" form. (The term "raw" refers to tapwater consumed as such and should not be construed to mean water that is untreated.) Vehicles for the intake of tapwater (other than tapwater itself) include coffee, tea, condensed or powdered milk and soup, homemade beer and wine, baby formula, and various "other types of beverages."

Figure 7 shows how the tapwater intake of each age group is apportioned among various beverages. A number of trends emerge from these data. For instance, the intake of "raw" tapwater is remarkably constant among all the groups 6 years of age and older. The increase in tapwater intake with age appears due entirely to the rapid growth of tea- and coffee-drinking in the 18-and-over age groups. This increase is more than sufficient to offset a decrease in the intake of "other types of drink" above the age of 17 (or thereabouts). These "other types of drink" are not identified in the survey; one can speculate that this decline may be the result of high

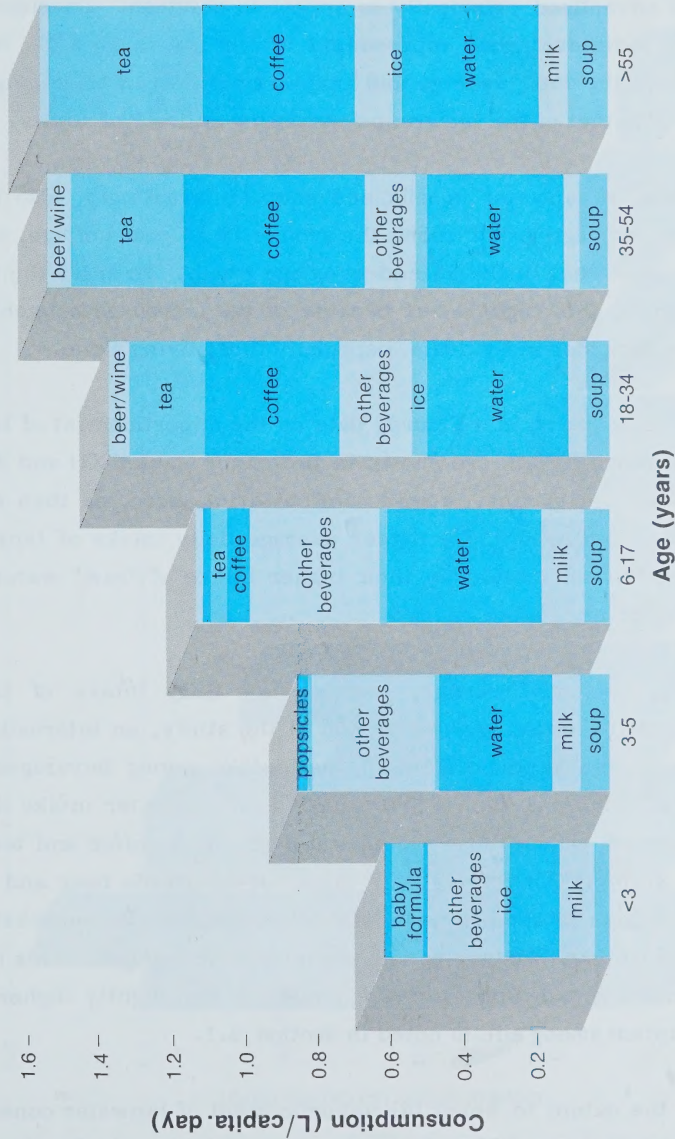


FIGURE 7 Distribution of Tapwater Consumption Among the Different Beverages :
by age group, both sexes and seasons

consumption in the younger age groups of powdered, pre-mixed drinks designed and advertised principally to appeal to children. Considering the wide range of individual sizes represented by the age range 6-17, it is also noteworthy that the total average daily tapwater intake of this age group is as close as it is to that of the age groups consisting entirely of adults.

The intake of tapwater in milk and soup, interestingly, also declines relative to the 6-17 age group among the groups 18-54 years of age, although it rises again somewhat in the 55-and-over age group. To enter the realm of speculation again, this might occur because of the increased convenience of such products for older individuals, especially those living alone.

Although not shown in a Figure, data on the apportionment of tapwater intake broken down by sex are shown in Reference Tables XII and XIII. In the 35-and-over age groups, women tend to drink more tea than do men. And in the 6-17 age group, the higher average daily intake of tapwater of males is accounted for largely by their higher intake of "raw" water and of "other types of drink".

Although, as noted earlier, the average daily intake of tapwater remained essentially unchanged by season in the study, an interesting shift is observable in the apportionment of that intake among beverages in the case of adults. Figure 8 shows that while "raw" tapwater intake does not change with season among those age 18 and over, both coffee and tea intake increases in winter. Conversely, the intake of homemade beer and wine is almost twice as high in summer as in winter; soup intake is somewhat higher in winter, and milk and ice/mix remain essentially unchanged. This increase in tea and coffee consumption is responsible for the slightly higher winter water consumption among adults noted in Section 2.1.

Data on the extent to which the apportionment of tapwater consumption among various beverages differs by region are available only for the summer portion of the survey and, hence, are not included in the Reference Tables.

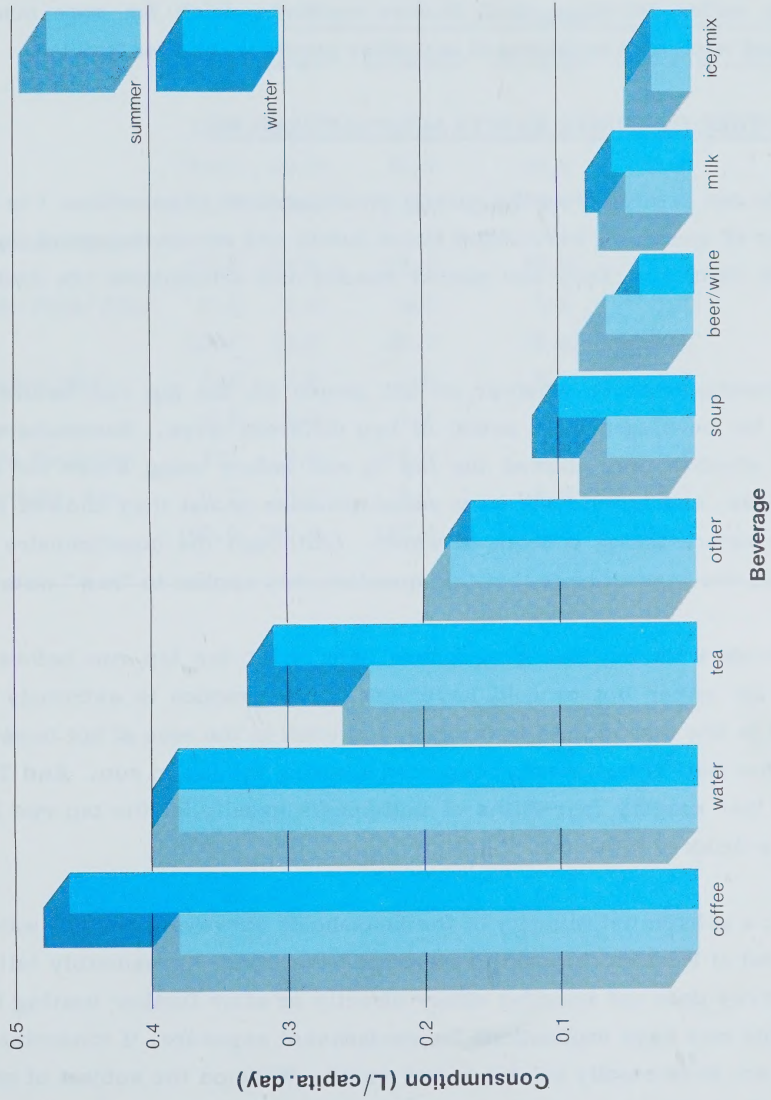


FIGURE 8 Seasonal Variation of Beverage Consumption: total population

However, Table 5 shows that residents of the Maritime provinces and of British Columbia tend to be heavy tea drinkers; Maritimers, especially, rank low in coffee-drinking. And Quebec residents drink far more homemade beer and wine than residents of any other province, and far less tea.

2.3 OTHER CONSUMER HABITS AND PREFERENCES

As can be seen from the survey questionnaires (Appendices I to III), a number of questions were asked about habits and circumstances of tapwater use for drinking. Only the clearer results and correlations are dealt with here.

Questions about whether or not people let the tap run before using water for beverages were asked in two different ways. Homemakers were asked whether they allowed the tap to run before using water for making beverages, and individuals were asked whether or not they allowed the tap to run before taking a drink of water. (Although the questionnaire is not explicit, the implication is that this question only applies to "raw" water.)

Table 6 shows that homemakers usually let the tap run before using water for either hot or cold beverages. The practice is extremely widespread in the case of cold beverages; but even in the case of hot beverages, more than half of homemakers reported allowing the tap to run. And Table 7 shows that roughly four-fifths of individuals usually let the tap run before taking a drink of tapwater.

In a substantial minority of the households surveyed, the hot water tap was used at least on occasion to make hot beverages -- presumably (although the survey does not specify) either directly or after further heating (Table 8). This may have implications for contaminant exposure, if contaminants in piping are more readily soluble in hot water. While on the subject of contaminants in piping, it is worth noting (Table 9) that 79 percent of households sampled identified copper as being the piping material in the water system.

TABLE 5 Apportionment of Tapwater Consumption among Various Beverages
by Region (Summer only), in Percentages

	Region					
	<u>Total</u>	<u>B.C.</u>	<u>Prairies</u>	<u>Ontario</u>	<u>Quebec</u>	<u>Maritimes</u>
Tea	15.7	20.5	18.3	16.7	9.5	26.0
Coffee	20.9	19.2	27.8	25.3	17.3	12.4
Milk	4.7	5.1	2.1	3.4	5.7	8.5
Other Reconstituted Drinks	17.0	22.6	13.1	17.9	17.0	14.5
Homemade Beer/Wine	3.4	1.5	0.4	1.5	7.7	0.4
Water	29.7	22.7	31.7	28.0	32.6	28.1
Water as Ice/Mix	2.3	3.2	1.8	2.9	1.8	2.5
Soup	4.7	4.0	4.4	3.0	6.8	4.1
Homemade Popsicles	1.2	0.9	0.3	0.7	1.6	2.7
Baby Formula, etc.	<u>0.3</u>	<u>0.3</u>	<u>0.1</u>	<u>0.6</u>	<u>0.1</u>	<u>0.7</u>
	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 6 Running Tap Before Using Water for Beverages (Homemakers)

	<u>Cold Beverages</u>		<u>Hot Beverages</u>	
	<u>Number</u>	<u>Percentage</u>	<u>Number</u>	<u>Percentage</u>
Run tap first	242	82.0	154	52.2
Do not run tap first	28	9.5	104	35.3
Do not make such beverages	21	7.1	34	11.4
Not stated	4	1.4	3	1.0
Total	295	100.0	295	100.0

TABLE 7 Tap-Flushing Habits (Individuals)

<u>Flush Taps Before Taking a Drink</u>	<u>Number</u>	<u>Percentage</u>
Usually	790	81.4
Seldom	103	10.6
Never	58	6.0
Did not state	19	2.0

Other piping materials included galvanized metal and plastic. Because of the small number of households involved, the reader should not ascribe too much importance to the proportions listed. The preponderance of copper piping, however, is clear, as is the fact that some households do use plastic and galvanized piping, and at least a few still use lead.

As shown in Reference Table XX, households drawing their water directly from well or lake sources tend to use very slightly less water than do those relying on municipal water supplies (the large majority of the population surveyed).

A seemingly perverse trend emerges in Reference Table XXI, which shows that people who are not very satisfied or not at all satisfied with the taste of their water supply tend to drink more of it than those who are "neutral". However, Reference Table XXII shows that as people become less satisfied with the taste of their water, they tend to drink more of it in forms other than "raw" water -- the effect being, perhaps, to disguise the taste.

Figures on the use of water softeners and purifiers (Reference Tables XXIII and XXIV) show that across the country 8.5 percent of households use water-softening devices, and 3.7 percent use water purifiers. Use of softeners is markedly highest in the Prairie provinces, and is not reported in British Columbia. Among the households using water softeners, 68 percent had water-softening devices on both hot- and cold-water supplies -- meaning that in those households (5.8 percent of the total), all drinking water used is softened.

No significance should be ascribed to the regional distribution of water purifier use shown in Reference Tables XXIII and XXIV, because of the very small number of households reporting use.

TABLE 8 Homemakers' Use of Hot Tap for Hot Beverages

<u>Frequency</u>	<u>Percentage</u>
Often	13.6
Sometimes	19.0
Seldom	12.9
Never	54.2
Not stated	0.3

TABLE 9 Types of Water Piping

<u>Type of Pipes</u>	<u>Percentage of Households</u>
Copper	79.0
Lead	3.1
Galvanized	9.8
Plastic	6.4
Other	1.7

3. COMMENTS, COMPARISONS AND CONCLUSIONS

3.1 TWO LITRES PER CAPITA PER DAY?

As mentioned in the introduction, the maximum acceptable concentrations (MAC) of drinking-water-quality parameters in the Guidelines for Canadian Drinking Water Quality - 1978¹ were derived on the assumption that an adult consumes two litres of tapwater and tapwater-based beverages daily. A similar assumption has been made by the U.S. Environmental Protection Agency in calculating maximum contaminant levels (MCL) for potable water.²³ In the World Health Organization's International Standards for Drinking Water, the total intake of tapwater is assumed to be 2.5 L/capita.day.²⁴

The present study provides data that put these assumptions into perspective. As noted in the previous chapter, approximately 12 percent of the population aged 18 and over were found to consume more than 2 L/day of tapwater. Even the higher daily tapwater intake level of 2.5 L/day is exceeded by approximately seven percent of the population aged 6-17, and nine percent of the population aged 18 and over. In both groups, intakes of tapwater reported by a few individuals in the sample (1.6 and 2.0 percent, respectively) were above 3.9 L/day, or almost double the 2 L/day level generally assumed for the purpose of setting water-quality guidelines.

The decision on what percentage of the population to protect in setting drinking-water-quality guidelines or standards -- that is, the decision on whether to assume for purposes of calculating body burdens a level of tapwater consumption exceeded by "only" 20 percent of the population, or 10 percent, or 1 percent -- involves value judgments that are beyond resolution on the basis of scientific evidence alone. Such evidence can, however, provide much-needed information on which to base such value judgments.

3.1.1 Consumption on a Volume per Unit-Body-Weight Basis

In setting standards, it is especially important to identify populations particularly at risk. In the case of tapwater contaminants, it is a reasonable assumption that one such population would comprise individuals whose intake of tapwater is very much higher than average, on a per-unit-of-body-weight basis (assuming that uptake of contaminants always varies directly with amount of tapwater consumed).

Table 10 provides data showing the average body weight of Canadians in each of the age groups into which the survey data were broken. These data can be used to calculate, in conjunction with the data in Reference Tables I-III, the average daily tapwater intake per kilogram of body weight implied by the survey results for various age groups. From the results of such calculations presented in Table 11, it can be seen that, on average, individuals in the 5-and-under age group consume approximately twice as much tapwater per kilogram of body weight as do older individuals (bearing in mind, once again, both the wide variations masked by averages and the heterogeneity of the 6-17 age group). There is, however, little important difference between the sexes in this age group. In contrast, women's daily intake is some 20 percent higher than men's on a body-weight basis for the adult age groups.

Children and infants, on the basis of their higher tapwater intake per kilogram body weight, probably constitute one of the populations especially at risk from contaminants in drinking water. Not only is their intake per unit of body weight higher than the adult population's, but they are also more susceptible to the toxic effects of certain contaminants (e.g., lead, nitrates). Such considerations were taken into account in setting MACs for the Canadian drinking-water guidelines,¹ but quantitative information on volumes consumed on a body-weight basis was lacking.

TABLE 10 Average Body Weight of Canadians for 1978-79:
by age group and sex²⁵

<u>Age group</u>	<u>Average Body Weight, kg</u>		
	<u>Females</u>	<u>Males</u>	<u>Both Sexes</u>
<3	13.0	14.2	13.7
3-5	17.2	18.6	18.0
6-17	42.3	46.2	44.3
18-34	58.3	74.4	66.3
35-54	65.3	78.3	71.8
55+	65.9	75.5	70.3
Total Population	55.6	65.1	60.3

TABLE 11 Average Daily Tapwater Intake of Canadians: expressed
as millilitres per kilogram body weight

<u>Age group</u>	<u>Average Daily Intake, mL/kg</u>		
	<u>Females</u>	<u>Males</u>	<u>Both Sexes</u>
<3	53	35	45
3-5	49	48	48
6-17	24	27	26
18-34	23	19	21
35-54	25	19	22
55+	24	21	22
Total Population	24	21	22

These arguments indicate the importance of building into the process of guideline- and standard-setting safety factors which ensure that acceptable concentrations of contaminants are set low enough to provide an adequate margin of safety for those groups whose exposure on a per-body-weight basis is highest. These groups comprise (as indicated by the data presented) infants and children, who might also be expected to be particularly vulnerable to the potential effects of a broad range of contaminants.

3.1.2 The Climate Factor

As indicated in the introductory chapter it is generally recognized that higher ambient air temperatures result in increased fluid intake. This temperature variation is one of the reasons that the Canadian survey involved both summer and winter sampling. The finding of the study that consumption of tapwater and tapwater-based fluids does not vary significantly from season to season appears contrary to expectations, but a number of factors may explain this. As observed by Welch *et al.*,²⁶ fluid intake increases only gradually in persons doing moderate to heavy work until the average ambient temperature reaches about 20°C. An examination of temperatures recorded during the periods in which diaries were completed during the summer phases of the survey (actually late summer/early fall) indicated that the daily mean temperatures experienced by the total population surveyed averaged about 17°C, and the average of the daily maximum temperatures recorded was only approximately 21.5°C. Even for those individuals in the sample involved in fairly active pursuits, a major increase in tapwater intake might not be expected in the present survey. It is worth noting this fact in the context of survey findings on the relationship between physical activity and tapwater intake, since not only higher average "summer" daily tapwater intake but also a more pronounced relationship between physical activity and daily tapwater intake might have been observed had the summer portion of the survey taken place under more representative climatic conditions. Even this is uncertain because a number

of other factors must be considered, including the tendency for a substantial portion of the population to spend time in climate-controlled surroundings. It is also possible, of course, that additional fluid requirements in warmer weather tend to be met primarily by increases of consumption of non-tapwater-based beverages like beer, wine and soft drinks. Because the present survey considered only tapwater-based beverages (see Section 3.1.3), the extent to which this was true in the period in question cannot be determined from the data.

3.1.3 Tapwater Consumption and Total Fluid Intake

As indicated previously, attempts were not made in this survey to record information on volumes of fluids consumed other than those derived from tapwater. However, a value for the average total intake of fluids by Canadians may be estimated using data compiled elsewhere. Thus, the per capita consumption of fluid milk, alcoholic beverages and soft drinks in 1977 amounted to approximately 0.28, 0.27 and 0.17 L/day, respectively.²⁷ Combining these values with that for average tapwater intake (1.34 L/day) would indicate the overall average daily intake of beverages in Canada to be near 2 L/day, an amount which falls within the range of total fluid values generally cited in physiology texts.

3.2 COMPARATIVE RESULTS

The results of the present survey are interesting to examine in the context of other attempts made to study daily tapwater intake, specifically the recent studies conducted in the United Kingdom³ and the Netherlands.²

3.2.1 Total Tapwater Consumption in Canada and Elsewhere

A comparison of values for average daily tapwater consumption from all sources in the Canadian, Dutch and British studies is provided in Table 12. It appears clear that Canadians (in all age groups) consume more tapwater

TABLE 12 Average Daily Tapwater Consumption in Different Countries
(L/capita.day)

Canada			Holland ²			United Kingdom ³		
Age Group	F	M	Age Group	F	M	Age Group	F	M
<3	0.69	0.50						
			<4	0.56	0.62			
						1-4	0.46	0.48
3-5	0.85	0.90						
						5-11	0.53	0.55
			5-17	0.85	0.95			
6-17	1.00	1.27				12-17	0.73	0.81
						18-30	0.99	1.01
18-34	1.33	1.43						
			18-55	1.19	1.27			
						31-54	1.09	1.20
35-54	1.63	1.47						
55+	1.55	1.59	55+	1.21	1.37	55+	1.03	1.13

than their European counterparts. We say "appears" because the differences among the countries in quantities consumed may be merely an artifact arising from the different methods used in each of the surveys to assess quantities consumed (definition of the size of drinking vessels and assessment of the contribution of tapwater to the total volume of tapwater-based beverages, for example).

Within Canada, there is apparently a considerable difference in average daily per capita tapwater consumption among the regions (Figure 5). The spread is some 30 percent between the highest and lowest consumptions -- 1.55 L/capita.day in Quebec and 1.18 L/capita.day in Ontario. No obvious reason is apparent for these regional differences, although the British study also found a difference (approximately 14 percent) in total-fluid intake between the North of England (the highest) and the South (the lowest), which was tentatively ascribed to differences in socio-economic groupings between the regions.³ (The British study showed a slight increase in total fluid intake from the highest to the lowest socio-economic groups. Comparable data are not available from the Canadian study.)

3.2.2 Beverages Made from Tapwater

There is little conformity in how beverages are classified in the various assessments made of amounts of tapwater-based beverages consumed. Two beverages, however, are unambiguously identified -- tea and coffee. Table 13 presents the estimates made of daily personal consumption of these two beverages in Canada and a number of European countries. There are wide differences both in preference for the beverages and in the quantities drunk. Danes, for example, drink almost no tea but have the highest coffee consumption, while residents of the Irish Republic have the highest tea consumption but one of the lowest coffee consumptions. Canadians show moderate consumptions of both beverages, with coffee being obviously preferred.

TABLE 13 Average Daily per Capita Consumption of Tea and Coffee
in a Number of Countries

<u>Country</u>	<u>Quantity Drunk, L/capita.day</u>		<u>Reference</u>
	<u>Coffee</u>	<u>Tea</u>	
Canada	0.49	0.29	This study
Belgium	0.45	0.03	2
Denmark	0.82	0.05	2
France	0.35	0.18	2
Germany (F.R.)	0.38	0.04	2
Irish Republic	0.14	1.10	2
Italy	0.23	0.01	2
Luxembourg	0.45	0.03	2
Netherlands	0.68	0.68	2
United Kingdom	0.29	0.71	3

The Canadian survey suggests that there are marked regional differences in preference for the different tapwater-based beverages (Table 5). In the absence of specific investigations aimed at elucidating these differences in regional preferences the possible reasons for them are limited only by one's imagination.

3.3 MISCELLANY

3.3.1 Water-Softener Use

A water softener is installed when a householder decides that the tapwater is objectionably hard for his purposes. For example, excessive soap may be required for washing purposes or incrustation of plumbing may be unacceptable. There is no conclusive evidence of direct health effects associated with drinking-water hardness or lack of it. Although, as mentioned earlier, a number of epidemiological investigations have suggested an inverse statistical correlation between drinking-water hardness and certain types of cardiovascular disease.

Water softening can result in the addition of high levels of sodium to the water, particularly where certain ion-exchange processes are employed. Because of the suggested link between sodium and hypertension, a World Health Organization working group recently recommended that "trends towards increasing sodium levels in water supplies should be discouraged".²⁸ And indeed, the Guidelines for Canadian Drinking Water Quality - 1978 state that "where softening by ion-exchange is considered necessary, it is recommended that a separate unsoftened supply be retained for drinking and culinary purposes."¹

The use of household water softeners shows wide regional variation in Canada (Reference Table XXIX). For Ontario, where municipal drinking water is generally classified as medium hard,¹⁸ the survey shows that 9.3 percent of households have water softeners (a figure close to the nation-

wide average of 8.5 percent). In the Prairies, where drinking water is generally classified as hard to very hard,¹⁸ nearly one quarter of households have water softeners (the highest proportion in Canada). The absence of water softeners in houses surveyed in British Columbia is likely indicative of the fact that municipal water supplies in that province are generally classified as soft or very soft.¹⁸

For most household purposes a water softener need only be installed in the hot-water system because this system tends to suffer greater incrustation problems and is also the one used for washing purposes. To do so, however, often necessitates more extensive re-plumbing than would be required if the softener were installed to serve both the hot- and cold-water systems. This is probably why nearly 70 percent of surveyed households with water softeners have them serving both systems.

3.3.2 Tap Flushing and Hot-Water Use

Flushing a tap prior to water use should provide water in which the concentrations of contaminants dissolved from the household plumbing is lower than if no flushing took place, especially if the water has stood in the pipe for some time. Water from the hot-water system may also contain higher levels of such pollutants than that from the cold.

Most Canadians surveyed reported usually flushing the tap before using the water (Tables 6 and 7). The Dutch also show a preference for flushing the tap before use, 59 percent reporting they usually or sometimes flushed the tap.² On the other hand, a high proportion (77%) of Britons do not flush the tap prior to taking a drink.³ When questioned about the use of the hot-water tap for making hot beverages (Table 8) 67.1 percent of Canadian homemakers said they seldom or never used hot tapwater, whereas 13.6 percent said they often did. Thus, most Canadians seem to prefer drawing water in a manner that should minimize contaminant intake.

3.4 CONCLUDING REMARKS

This report highlights some results of the first nationwide study of Canadian drinking water habits. The choice of features to present and discuss from the large amount of data collected in the survey was based on what seemed most pertinent or suggested interesting trends in tapwater consumption.

It would be desirable to conduct in Canada a survey involving a larger sample, and including not only tapwater-based beverages but all beverages. This would be desirable for a number of reasons:

- (a) A larger sample size than that involved in the present study (closer to the much larger Dutch and British studies) would provide more statistically-reliable results. As an example of the statistical fragility of the results of the present survey, the average daily tapwater consumption of the entire population can only be reported with 90 percent confidence to lie somewhere between 0.86 and 1.82 L/capita.day. Averages dealing with smaller subsets of the population obviously are subject to even greater ranges of uncertainty.
- (b) Investigation of intake of non-tapwater-based beverages in the same survey as tapwater-based ones would provide more reliable information on total fluid intakes, and would also permit verification of hypotheses such as the one mentioned earlier, that increased fluid requirements in warmer weather may be made up by non-tapwater-based beverages.

4. REFERENCES

1. Health and Welfare Canada, Guidelines for Canadian Drinking Water Quality - 1978, Catalogue No. H48-10/1978. Hull: Canadian Government Publishing Centre (1979).
2. Haring, B.J.A., "Human exposure to metals released from water distribution systems, with particular reference to water consumption patterns", Tribune du Cebedeau, 31: 349 (1978).
3. Hopkin, S.M., and J.C. Ellis, Drinking Water Consumption in Great Britain, Technical Report TR 137, Medmenham Laboratory, Water Research Centre (June 1980).
4. Pike, R.L., and M.L. Brown, Nutrition: An Integrated Approach, 2nd. Edition. Toronto: John Wiley and Sons Inc. (1975).
5. Guyton, A.C., Textbook of Medical Physiology, 4th Edition. Toronto: W.B. Saunders Company (1971).
6. Beck, W.S., Human Design: Molecular, Cellular and Systemic Physiology. New York: Harcourt Brace Jovanovich Inc. (1971).
7. Cronkite, E.P. (ed.), "Blood and lymph". In Brobeck, J.R. (ed.), Physiological Basis of Medical Practice. Baltimore: The Williams and Wilkins Co. (1973).
8. Goodhart, R.S., and M.E. Shils (eds.), Modern Nutrition in Health and Disease: Dietotherapy, 5th. Edition. Philadelphia: Lea and Febiger (1973).
9. Bourne, G.H., and G.W. Kidder (eds.), Biochemistry and Physiology of Nutrition, Volume 1. New York: Academic Press Inc. (1953).

10. Joliffe, N. (ed.), Clinical Nutrition, 2nd. Edition. New York: Harper and Brothers Publishers (1962).
11. Health and Welfare Canada, Dietary Standard for Canada, Revised Edition. Catalogue No. H58-26/1975. Hull: Canadian Government Publishing Centre (1975).
12. National Academy of Sciences, Recommended Dietary Allowances, 8th. Revised Edition. Washington: National Academy of Sciences (1974).
13. Galagan, D.J. et al., "Climate and fluid intake", Pub. Hlth. Reps., 72: 484 (1957).
14. Molnar, G.W. et al., "A comparative study of water, salt and heat exchanges of men in tropical and desert environments", Am. J. Hyg., 44: 411 (1946).
15. Galagan, D.J., "Climate and controlled fluoridation", J. Am. Dental Assoc., 47: 159 (1953).
16. Henschel, A., "Water balance: a problem in occupational health", Occup. Hlth. Rev., 17: 11 (1965).
17. Wyndham, C.H., and N.B. Strydom, "The danger of an inadequate water intake during marathon running", S.A. Med. J., 43: 893 (1969).
18. Health and Welfare Canada, Guidelines for Canadian Drinking Water Quality 1978: Supporting Documentation, Catalogue No. H48-10/1978-IE. Hull: Canadian Government Publishing Centre (1980).
19. Craun, G.F., and L.J. McCabe, "Problems associated with metals in drinking water", J. Am. Water Works Assoc., 67: 593 (1975).

20. Wong, C.S., and P. Berrang, "Contamination of tap water by lead pipe and solder", Bull. Environ. Contam. Toxicol., 15: 530 (1976).
21. Neri, L.C., D. Hewitt, and J.S. Mandel, "Relation between mortality and water hardness in Canada", Lancet I, 931 (1972).
22. Schroeder, H.A., "Cardiovascular mortality, municipal water, and corrosion", Arch. Environ. Hlth., 23: 303 (1974).
23. United States Environmental Protection Agency, National Interim Primary Drinking Water Regulations, Report No. EPA-570/9-76-003. Washington: U.S. Government Printing Office (1976).
24. World Health Organization, International Standards for Drinking Water, 3rd Edition. Geneva (1971).
25. Unpublished results from the Canada Health Survey by the Information Systems Directorate, Policy, Planning and Information Branch, Department of National Health and Welfare. (Health and Welfare Canada and Statistics Canada, The Health of Canadians: Report of the Canada Health Survey, Catalogue No. 82-538E. Hull: Canadian Government Publishing Centre (1981).)
26. Welch, B.E., E.R. Burskirk, and P.E. Iampietro, "Relation of climate and temperature to food and water intake in man", Metabolism, 7: 141 (1958).
27. Statistics Canada, Apparent Per Capita Food Consumption in Canada, Catalogue Nos. 32-329, 32-230 (1981).
28. World Health Organization, Sodium, Chlorides and Conductivity in Drinking Water, report on a WHO working group, The Hague, 1978. Copenhagen: WHO regional Office for Europe (1979).

APPENDIX I

HOUSEHOLD INFORMATION QUESTIONNAIRE

CANADIAN INTER-MARK

Project # 284-77

DRINKING WATER CONSUMPTION SURVEY

--	--	--	--	--	--	--

HOUSEHOLD INFORMATION

This questionnaire to be conducted by interviewer, with the male or female head of household.

- How many people usually live in this household including yourself? # _____
- Please give the names, sex and age of the members of this household, again including yourself?

Person Number	Name of member	Circle The Sex of Member	Year of Birth of Member
01	_____	M F	_____
02	_____	M F	_____
03	_____	M F	_____
04	_____	M F	_____
05	_____	M F	_____
06	_____	M F	_____
07	_____	M F	_____
08	_____	M F	_____
09	_____	M F	_____
10	_____	M F	_____

INTERVIEWER: If more than 10 household members please list the rest at end of questionnaire.

- Now, what type of school, excluding casual or interest type courses, did the male head of household last attend?
- What type of school, excluding casual or interest type courses, did the female head of household last attend?

	Household Head	
	MALE	FEMALE
SOME ELEMENTARY OR NONE -----	1	1
COMPLETED ELEMENTARY SCHOOL -----	2	2
SOME HIGH SCHOOL -----	3	3
COMPLETED HIGH SCHOOL -----	4	4
SOME COLLEGE -----	5	5
COMPLETED COLLEGE -----	6	6
SOME UNIVERSITY -----	7	7
COMPLETED UNIVERSITY OR MORE -----	8	8

Household Information Questionnaire - Page 2

4. Type of dwelling is?

HOUSE (detached or semi detached) ----- 1
 TOWN HOUSE OR ROW HOUSING ----- 2
 DUPLEX ----- 3
 LIVING QUARTERS ATTACHED TO BUSINESS ----- 4
 MOBILE HOME ----- 5
 APARTMENT BUILDING # of floors ----- 6
 OTHER ----- 7
 (please specify)

5. Year dwelling was built? Would you say. . . .

1940 or earlier ----- 1
 1941 to 1950 ----- 2
 1951 to 1960 ----- 3
 1961 to 1970 ----- 4
 1971 or later ----- 5

6a) What are the interior water pipes made of? Are they. . . .

Lead ----- 1
 Copper ----- 2
 Galvanized Iron ----- 3
 Plastic ----- 4
 Other ----- 5
 (please specify)
 Don't Know ----- 6

IF PIPES ARE PLASTIC OR PLASTIC PLUS ANOTHER TYPE ASK:

b) Do you know if the plastic pipes are. . . .

PVC ----- 1
 PE ----- 2
 CPVC ----- 3
 Don't know ----- 4

7. What is the source of your drinking water supply?

MUNICIPAL ----- 1
 WELL ----- 2
 LAKE ----- 3
 OTHER ----- 4
 (please specify)

8a) Is there a water softening system used?

YES ----- 1
 NO ----- 2

IF "YES" on Q.8a ASK:

b) Is it on the. . . .

Hot Water only ----- 1
 Hot and Cold water ----- 2

Household Information Questionnaire - Page 3

9a) Is a water purifier used?

YES ----- 1

NO ----- 2

IF "YES" on Q.9a ASK:

b) Is it permanently installed?

YES ----- 1

NO ----- 2

c) What is the name of the manufacturer of this water purifier? _____

Name of Respondent: _____

Address: _____

Interviewers Signature _____

Date of Interview _____

INTERVIEWER: Don't forget to take this questionnaire with you when you leave.

<u>Person Number</u>	<u>Name of member</u>	<u>Circle The Sex of Member</u>	<u>Year of Birth of Member</u>
11	_____	M F	_____
12	_____	M F	_____
13	_____	M F	_____
14	_____	M F	_____
15	_____	M F	_____

APPENDIX II

HOMEMAKER QUESTIONNAIRE

--	--	--	--	--	--	--

DRINKING WATER CONSUMPTION STUDY
SELF ADMINISTERED HOMEMAKER QUESTIONNAIRE

The person in the household who is the homemaker, housewife/housekeeper or person living alone please fill in this questionnaire.

PLEASE CIRCLE THE APPROPRIATE ANSWERS

- 1a) The first time you use the kitchen water tap in the morning do you usually run the tap first, before using the water or not?

RUN TAP FIRST ----- 1
DO NOT RUN TAP FIRST ----- 2

- b) What do you usually use the first kitchen tap water for

during the week - FOR BEVERAGES (such as tea, coffee,
juices, baby formula etc.) --- 1
FOR OTHER COOKING PURPOSES ----- 2
OTHER USES (such as washing etc.) ----- 3

during the weekend - FOR BEVERAGES (such as tea, coffee,
juices, baby formula etc.) --- 1
FOR OTHER COOKING PURPOSES ----- 2
OTHER USES (such as washing etc.) ----- 3

2. When you make cold beverages where water from tap is used, do you usually run tap first or not?

RUN TAP FIRST ----- 1
DO NOT RUN TAP FIRST ----- 2
DO NOT MAKE SUCH COLD BEVERAGES ----- 3

- 3a) When you make hot beverages where water from tap is used - do you usually run the tap first or not?

RUN TAP FIRST ----- 1
DO NOT RUN TAP FIRST ----- 2
DO NOT MAKE SUCH HOT BEVERAGES ----- 3

- b) How often do you use hot water from the hot water tank to make these hot beverages?

OFTEN ----- 1
SOMETIMES ----- 2
SELDOM ----- 3
NEVER ----- 4

- 4a) When you make soup where water from the tap is used do you usually run the tap first or not?

RUN TAP FIRST ----- 1
DO NOT RUN TAP FIRST ----- 2
DO NOT MAKE SUCH SOUPS ----- 3

- b) How often do you use hot water from the hot water tank to make soup?

OFTEN ----- 1
SOMETIMES ----- 2
SELDOM ----- 3
NEVER ----- 4

Self Administered Homemaker Questionnaire - Page 2

- 5a) Are there, in your house, any periods of five hours or more during the day and/or evening when the kitchen tap is not turned on at all?

YES ----- 1

NO ----- 2

- b) If so, how many days per week does this happen # of days _____.

Name of homemaker _____

Address _____

Province _____

THANK YOU FOR YOUR CO-OPERATION

APPENDIX III

INDIVIDUAL DIARIES OF WATER CONSUMPTION SUMMER AND WINTER VERSIONS

CANADIAN INTER-MARK

Project # 284-77

--	--	--	--	--	--	--	--	--	--

DRINKING WATER CONSUMPTION STUDY
SELF ADMINISTERED QUESTIONNAIRE TO BE FILLED
OUT BY EACH MEMBER OF HOUSEHOLD

We are interested in the amount of tap water you consume in any form whether as a glass of water or mixed with some other substance.

For our purposes please consider a day as a period from midnight to midnight and list below the number of times you take each type of drink in a day. We would like you to keep track of amount of water you consumed in ONE WEEKDAY and the amount you consumed in ONE WEEKEND day.

Please circle day you kept track of

TYPE OF DRINK	WEEKDAY		WEEKEND		FOR OFFICE USE ONLY			
	M	T	W	T		F	Sat.	Sun.
	HOME	OUTSIDE	HOME	HOME		HOME	HOME	HOME
TEA - # of cups of tea								
# of mugs of tea (holds more than a tea cup)								
COFFEE - # of cups of coffee								
# of mugs of coffee (holds more than a tea cup)								
MILK - only if reconstituted by adding water to milk powder								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
OTHER TYPE OF DRINK - only if reconstituted by adding water, to such things as powder, crystals, frozen juices, hot beef drinks, etc.								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
HOMEMADE BEER/WINE								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
WATER								
# of sips of water								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
WATER AND/OR ICE CUBES ADDED TO OTHER DRINKS NOT ALREADY MENTIONED								
# of drinks with ice or water								
SOUP - # of bowls of soup which had water added								
HOMEMADE POPSICLES								
# of popsicles								
BABY FORMULA/JUICE WITH WATER ADDED OR A BOTTLE OF WATER								
# of 8 ounces of formula or juice								
# of 4 ounces of formula or juice								
# of 8 ounces of water only								
# of 4 ounces of water only								

Other Uses

(please specify)

PLEASE CIRCLE APPROPRIATE ANSWERS

1. When you turn on the tap for a drink of water do you usually run the tap before you take a drink?

USUALLY RUN TAP ----- 1
 SELDOM RUN TAP ----- 2
 NEVER RUN TAP ----- 3

2. If you usually drink water from the tap during the night, how many of these night time drinks would you say you drink in an average week?

OF DRINKS IN AN AVERAGE WEEK -----
 DON'T USUALLY DRINK WATER
 FROM TAP DURING NIGHT ----- X

- 3a) If you usually drink water soon after you get up in the morning, do you usually drink a sip or a glass of water first, or do you wash etc. first?

DRINK WATER FROM TAP FIRST ----- 1
 WASH ETC. FIRST ----- 2
 NEITHER ----- 3

IF YOU DRINK WATER FIRST PLEASE ANSWER QUESTION 3b & 3c

- 3b) Where is the tap you usually use to get this first morning drink of water is it

a bathroom tap ----- 1
 kitchen tap ----- 2
 other ----- 3
 (please specify)

- 3c) Are you the first in the household using this particular tap in the morning?

FIRST IN HOUSEHOLD TO USE TAP ----- 1
 SOMEONE ELSE USES IT FIRST ----- 2
 DON'T KNOW ----- 3

4. In general, how satisfied would you say you are with the taste of your drinking water?

COMPLETELY SATISFIED ----- 1
 NOT VERY SATISFIED ----- 2
 NEUTRAL OR NO OPINION ----- 3
 NOT VERY SATISFIED ----- 4
 NOT AT ALL SATISFIED ----- 5

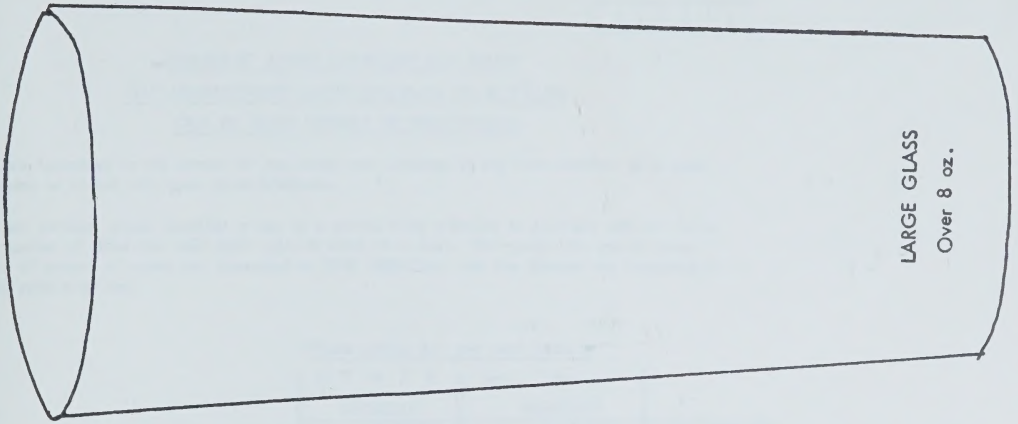
Name of household member _____

Address _____

Province _____

If other person completed this questionnaire for another member please include your name here _____

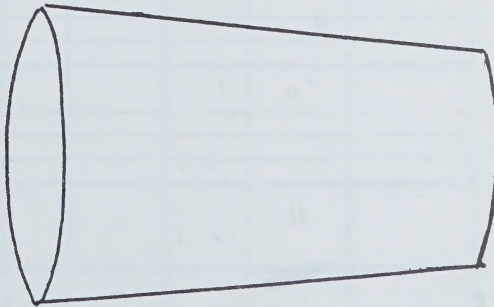
THANK YOU FOR YOUR CO-OPERATION



LARGE GLASS
Over 8 oz.



MEDIUM GLASS
5 - 8 oz.



SMALL GLASS
4 oz. or less

--	--	--	--	--	--	--	--

DRINKING WATER CONSUMPTION STUDY
SELF ADMINISTERED QUESTIONNAIRE TO BE FILLED
OUT BY EACH MEMBER OF HOUSEHOLD

We are interested in the amount of tap water you consume in any form whether as a glass of water or mixed with some other substance.

For our purposes please consider a day as a period from midnight to midnight and list below the number of times you take each type of drink in a day. We would like you to keep track of amount of water you consumed in ONE WEEKDAY and the amount you consumed in ONE WEEKEND day.

Please circle day you kept track of

TYPE OF DRINK	M	T	W	T	F	Sat.	Sun.	FOR OFFICE USE ONLY
	WEEKDAY					WEEKEND		
	HOME	OUTSIDE HOME	HOME	OUTSIDE HOME	HOME	OUTSIDE HOME		
TEA - # of cups of tea								
# of mugs of tea (holds more than a tea cup)								
COFFEE - # of cups of coffee								
# of mugs of coffee (holds more than a tea cup)								
MILK - only if reconstituted by adding water to milk powder								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
OTHER TYPE OF DRINK - only if reconstituted by adding water, to such things as powder, crystals, frozen juices, hot beef drinks, etc.								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
HOMEMADE BEER/WINE								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
WATER								
# of sips of water								
# of small glasses (4 ounces or less)								
# of medium glasses (5 to 8 ounces)								
# of large glasses (more than 8 ounces)								
WATER AND/OR ICE CUBES ADDED TO OTHER DRINKS NOT ALREADY MENTIONED								
# of drinks with ice or water								
SOUP - # of bowls of soup which had water added								
HOMEMADE POPSICLES								
# of popsicles								
BABY FORMULA/JUICE WITH WATER ADDED OR A BOTTLE OF WATER								
# of 8 ounces of formula or juice								
# of 4 ounces of formula or juice								
# of 8 ounces of water only								
# of 4 ounces of water only								

Other Uses

(please specify)

IF YOU ARE 16 YEARS OF AGE OR OLDER, PLEASE ANSWER QUESTION 1. AND 2.

Q.1 Compared to most of the people you know, that are about your age, how physically active would you say you are at work?

EXTREMELY ACTIVE AT WORK 1
 VERY ACTIVE AT WORK 2
 SOMEWHAT ACTIVE AT WORK 3
 NOT VERY ACTIVE AT WORK 4
 NOT AT ALL ACTIVE AT WORK 5

Q.2 Compared to most of the people you know, that are about your age, how physically active would you say you are in your spare time?

EXTREMELY ACTIVE IN MY SPARE TIME 1
 VERY ACTIVE IN MY SPARE TIME 2
 SOMEWHAT ACTIVE IN MY SPARE TIME 3
 NOT VERY ACTIVE IN MY SPARE TIME 4
 NOT AT ALL ACTIVE IN MY SPARE TIME 5

IF YOU ARE THE MALE/FEMALE HEAD OF HOUSE, PLEASE ANSWER QUESTION 3.

Q.3 We would like to know the kind of material the water pipes in your home are made of. The water pipes we want to know about are the pipes that lead the hot and/or cold water to your taps in the kitchen and/or bathroom.

Are these water pipes ...

LEAD 1
 COPPER 2
 GALVANIZED IRON 3
 PLASTIC 4
 OTHER 5

(please specify)

No Indoor Water Supply .. 6

NOTE: If you are not sure, would you please look under your kitchen sink. The water lead in pipes are the ONLY pipes we are concerned with. Copper and plastic are easy to identify. Lead will mark easy if scratched with your finger nail, galvanized iron is hard and will not mark easily.

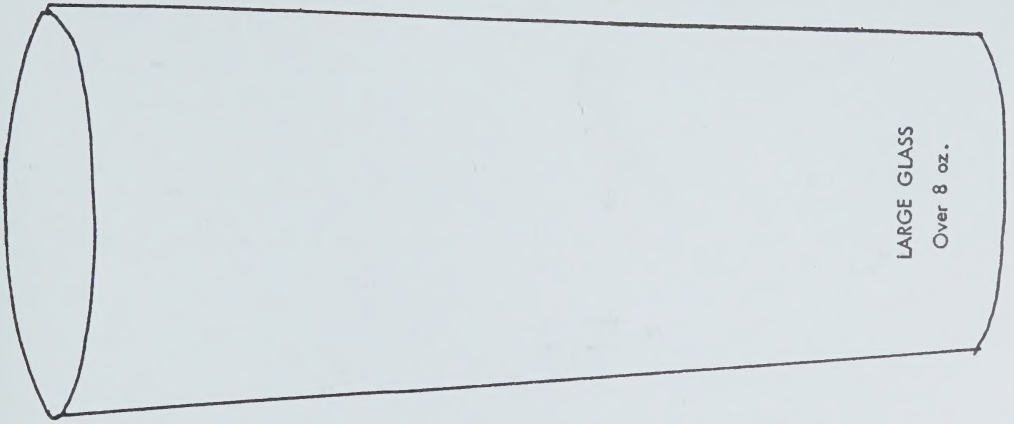
Name of household member: _____

Address: _____

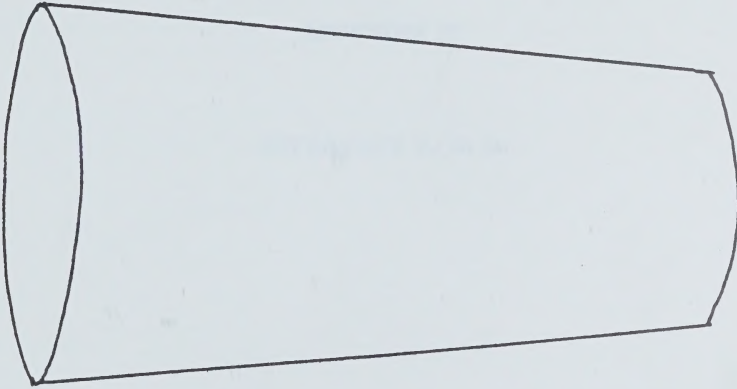
Province: _____

If other person completed this questionnaire for another member please include your name below:

THANK YOU FOR YOUR CO-OPERATION



LARGE GLASS
Over 8 oz.



MEDIUM GLASS
5 - 8 oz.



SMALL GLASS
4 oz. or less

APPENDIX IV

REFERENCE TABLES

Note: In some tables, column totals may not correspond exactly with the more aggregated figures cited in the text of the report or shown elsewhere in the Reference Tables. This is because of rounding errors.

I AVERAGE DAILY TAPWATER CONSUMPTION AND RANGES FOR BOTH SEXES COMBINED:
by age, combined seasons (L/capita.day)

	Age Group						
	Under 3	3 - 5	6 - 17	18 - 34	35 - 54	55 & Over	All Ages
Average	0.61	0.87	1.14	1.38	1.55	1.57	1.34
90% or more of sample above*...	0.14	0.37	0.36	0.51	0.80	0.87	0.43
90% or more of sample below*...	1.50	1.50	2.21	2.57	2.57	2.29	2.36

II AVERAGE DAILY TAPWATER CONSUMPTION AND RANGES FOR FEMALES: by age,
combined seasons (L/capita.day)

	Age Group						
	Under 3	3 - 5	6 - 17	18 - 34	35 - 54	55 & Over	All Ages
Average	0.69	0.85	1.00	1.33	1.63	1.55	1.31
90% or more of sample above*...	0.14	0.43	0.36	0.51	0.80	0.87	0.50
90% or more of sample below*...	1.50	1.50	1.79	2.50	2.64	2.28	2.30

* NOTE: Precise deciles are impossible to determine because of the way the data are tabulated in original study. E.g., in an age group containing 250 people, the consumer of the 26th highest or lowest volume of water may fall somewhere in a 0.5 litre/week range. In such cases, the figures shown may reflect slightly broader ranges than would have been isolated under ideal conditions in that they refer to the top (or bottom) of the range in which the relevant individual's consumption falls.

III AVERAGE DAILY TAPWATER CONSUMPTION AND RANGES FOR MALES: by age, combined seasons (L/capita.day)

	Age Group						
	Under 3	3 - 5	6 - 17	18 - 34	35 - 54	55 & Over	All Ages
Average	0.50	0.90	1.27	1.43	1.47	1.59	1.37
90% or more of sample above*...	0.14	0.37	0.50	0.57	0.73	0.86	0.50
90% or more of sample below*...	1.07	1.57	2.64	2.57	2.57	2.29	2.43

IV AVERAGE DAILY TAPWATER CONSUMPTION AND RANGES: by age groupings, both sexes, combined seasons (L/capita.day)

	Age Grouping		
	5 & Under	6 - 17	18 & Over
Average	0.76	1.14	1.49
90% or more of sample above*...	0.23	0.37	0.64
90% or more of sample below*...	1.50	2.21	2.59

* NOTE: Precise deciles are impossible to determine because of the way the data are tabulated in original study. E.g., in an age group containing 250 people, the consumer of the 26th highest or lowest volume of water may fall somewhere in a 0.5 litre/week range. In such cases, the figures shown may reflect slightly broader ranges than would have been isolated under ideal conditions in that they refer to the top (or bottom) of the range in which the relevant individual's consumption falls.

V DAILY CONSUMPTION DISTRIBUTION BY AGE GROUP (500 mL INCREMENTS): both sexes, combined seasons

Amount Drunk (L/capita.day)	Total Population %	Age Group		
		5 & Under (% of total population)	6 - 17	18 & Over
0.0-0.5	10.3	3.3	4.5	2.5
0.5-1.0	24.7	2.5	8.0	14.2
1.0-1.5	32.2	1.8	7.6	22.8
1.5-2.0	16.3	0.7	2.5	13.1
2.0-2.5	7.9	0.2	1.3	6.4
2.5-3.0	4.9	-	1.2	3.7
3.0-3.5	1.5	-	0.1	1.4
3.5-4.0	1.0	-	-	1.0
>4.0	1.1	-	0.4	0.7

VI DAILY CONSUMPTION DISTRIBUTION BY AGE GROUP (APPROX. 200 mL INCREMENTS):
both sexes, combined seasons

Amount Drunk L/capita.day	Age Group					
	5 & Under		6 - 17		18 & Over	
	%	Number	%	Number	%	Number
0.00 - 0.21	11.1	9	2.8	7	0.5	3
0.22 - 0.43	17.3	14	10.0	25	1.9	12
0.44 - 0.65	24.8	20	13.2	33	5.9	38
0.66 - 0.86	9.9	8	13.6	34	8.5	54
0.87 - 1.07	11.1	9	14.4	36	13.1	84
1.08 - 1.29	11.1	9	14.8	37	14.8	94
1.30 - 1.50	4.9	4	9.6	24	15.3	98
1.51 - 1.71	6.2	5	6.8	17	12.1	77
1.72 - 1.93	1.2	1	2.4	6	6.9	44
1.94 - 2.14	1.2	1	1.2	3	5.6	36
2.15 - 2.36	1.2	1	4.0	10	3.4	22
2.37 - 2.57	-	0	0.4	1	3.1	20
2.58 - 2.79	-	0	2.4	6	2.7	17
2.80 - 3.00	-	0	2.4	6	1.4	9
3.01 - 3.21	-	0	0.4	1	1.1	7
3.22 - 3.43	-	0	-	0	0.9	6
3.44 - 3.64	-	0	-	0	0.8	5
3.65 - 3.86	-	0	-	0	-	0
>3.86	-	0	1.6	4	2.0	13
TOTAL	100.0	81	100.0	250	100.0	639

VII DAILY CONSUMPTION DISTRIBUTION BY AGE GROUP (APPROX. 200 mL INCREMENTS):
by sex, combined seasons

	Age Group					
	5 & Under		6 - 17		18 & Over	
	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>
Total in Group	332	307	125	125	46	35
Amount Drunk L/capita.day						
0.00 - 0.21	6.5%	17.1%	2.4%	3.2%	0.6%	0.3%
0.22 - 0.43	17.4	17.1	13.6	6.4	0.9	2.9
0.44 - 0.65	28.3	20.0	17.6	8.8	6.9	4.9
0.66 - 0.86	13.0	5.7	16.0	11.2	7.5	9.4
0.87 - 1.07	8.7	14.3	12.0	16.8	13.3	13.0
1.08 - 1.29	8.7	14.3	10.4	19.2	13.6	16.0
1.30 - 1.50	8.7	-	11.2	8.0	17.8	12.7
1.51 - 1.71	4.3	8.6	5.6	8.0	11.7	12.4
1.72 - 1.93	2.2	-	3.2	1.6	7.8	5.9
1.94 - 2.14	-	2.9	0.8	1.6	4.2	7.2
2.15 - 2.36	2.2	-	4.0	4.0	3.0	3.9
2.37 - 2.57	-	-	-	0.8	3.6	2.6
2.58 - 2.79	-	-	0.8	4.0	3.3	2.0
2.80 - 3.00	-	-	1.6	3.2	0.6	2.3
3.01 - 3.21	-	-	-	0.8	1.2	1.0
3.22 - 3.43	-	-	-	-	0.6	1.3
3.44 - 3.64	-	-	-	-	0.3	1.3
3.65 - 3.86	-	-	-	-	-	-
>3.86	-	-	0.8	2.4	3.0	1.0

VIII AVERAGE DAILY TAPWATER CONSUMPTION: by age, by season (L/capita.day)

	<u>Age</u>						
	<u>Under 3</u>	<u>3 - 5</u>	<u>6 - 17</u>	<u>18 - 34</u>	<u>35 - 54</u>	<u>55 & Over</u>	<u>All Ages</u>
Summer	0.57	0.86	1.14	1.33	1.52	1.53	1.31
Winter	0.66	0.88	1.13	1.42	1.59	1.62	1.37
Summer/ Winter	0.61	0.87	1.14	1.38	1.55	1.57	1.34

IX AVERAGE DAILY TAPWATER CONSUMPTION IN RELATION TO REGION OF CANADA:
OF CANADA: all ages, both seasons (L/capita.day)

	<u>Number of People</u>	<u>Summer</u>	<u>Winter</u>	<u>Combined Seasons</u>
Maritimes	81	1.40	1.47	1.43
Quebec	307	1.50	1.60	1.55
Ontario	367	1.15	1.21	1.18
Prairies	136	1.25	1.19	1.22
British Columbia	79	1.37	1.42	1.39
TOTAL	970	1.31	1.37	1.34

X AVERAGE DAILY TAPWATER CONSUMPTION AS A FUNCTION OF PHYSICAL ACTIVITY
AT WORK AND IN SPARE TIME: 16 years and older, combined seasons
(L/capita.day)

	Work		Spare Time	
	Consumption L/capita.day	Number of Respondents	Consumption L/capita.day	Number of Respondents
Extremely active	1.72	99	1.57	52
Very active	1.47	244	1.51	151
Somewhat active	1.47	217	1.44	302
Not very active	1.27	67	1.52	131
Not at all active	1.30	16	1.35	26
Did not state	1.30	<u>45</u>	1.31	<u>26</u>
TOTAL		688		688

XI AVERAGE DAILY TAPWATER CONSUMPTION APPORTIONED AMONG VARIOUS BEVERAGES:
both sexes, by age, combined seasons (L/capita.day)

	Age Group					
	Under 3	3 - 5	6 - 17	18 - 34	35 - 54	55 & Over
Total in Group	34	47	250	232	254	153
Water	0.14	0.31	0.42	0.39	0.38	0.38
Ice/Mix	0.01	0.01	0.02	0.04	0.03	0.02
Tea	*	0.01	0.05	0.21	0.31	0.42
Coffee	0.01	*	0.06	0.37	0.50	0.42
"Other type of drink"	0.21	0.34	0.34	0.20	0.14	0.11
Milk	0.10	0.08	0.12	0.05	0.04	0.08
Soup	0.04	0.08	0.07	0.06	0.08	0.11
Homemade beer/wine	*	*	0.02	0.04	0.07	0.03
Homemade popsicles	0.01	0.03	0.03	0.01	*	*
Baby formula, etc.	0.09	*	*	*	*	*
TOTAL	0.61	0.86	1.14	1.38	1.55	1.57

* less than 0.01 L/capita.day

XII FEMALES -- AVERAGE DAILY TAPWATER CONSUMPTION APPORTIONED AMONG
VARIOUS BEVERAGES: by age, combined seasons (L/capita.day)

	Age Group					
	Under 3	3 - 5	6 - 17	18 - 34	35 - 54	55 & Over
Total in Group	20	26	125	126	132	74
Water	0.17	0.32	0.37	0.35	0.42	0.36
Ice/mix	0.01	0.01	0.02	0.03	0.02	0.02
Tea	*	*	0.07	0.24	0.34	0.48
Coffee	0.01	*	0.07	0.38	0.53	0.39
"Other type of drink"	0.26	0.33	0.28	0.18	0.15	0.11
Milk	0.09	0.08	0.08	0.04	0.04	0.07
Soup	0.04	0.08	0.08	0.06	0.09	0.10
Homemade beer/wine	*	*	0.01	0.02	0.03	0.01
Homemade popsicles	0.01	0.03	0.02	0.01	*	*
Baby formula, etc.	0.09	*	*	*	*	*
TOTAL	0.69	0.85	1.00	1.33	1.62	1.55

XIII MALES -- AVERAGE DAILY TAPWATER CONSUMPTION APPORTIONED AMONG
VARIOUS BEVERAGES: by age, combined seasons (L/capita.day)

	Age Group					
	Under 3	3 - 5	6 - 17	18 - 34	35 - 54	55 & Over
Total in Group	14	21	125	106	122	79
Water	0.09	0.30	0.47	0.44	0.34	0.39
Ice/mix	*	0.02	0.02	0.04	0.03	0.03
Tea	*	0.01	0.03	0.17	0.27	0.37
Coffee	*	0.01	0.05	0.36	0.47	0.44
"Other type of drink"	0.14	0.35	0.41	0.22	0.13	0.11
Milk	0.10	0.08	0.16	0.08	0.04	0.08
Soup	0.04	0.07	0.07	0.06	0.08	0.12
Homemade beer/wine	*	*	0.02	0.06	0.12	0.04
Homemade popsicles	0.02	0.04	0.03	*	*	*
Baby formula, etc.	0.10	*	*	*	*	*
TOTAL	0.50	0.90	1.27	1.43	1.47	1.59

* less than 0.01 L/capita.day

XIV AVERAGE DAILY TAPWATER CONSUMPTION APPORTIONED AMONG
VARIOUS BEVERAGES: respondents aged 18 and over, by
season (L/capita.day)

	<u>Summer</u>	<u>Winter</u>
Water	0.38	0.38
Ice/Mix	0.03	0.03
Tea	0.24	0.31
Coffee	0.38	0.46
"Other type of drink"	0.18	0.16
Milk	0.05	0.06
Soup	0.07	0.10
Homemade beer/wine	0.07	0.04
Homemade popsicles	*	*
Baby formula, etc.	*	*

* less than 0.01 L/capita.day

XV AVERAGE VOLUME OF TAPWATER CONSUMED AMONG HOT AND COLD BEVERAGES: by age,
both sexes, combined seasons (L/capita.day)

	<u>Under 3</u>	<u>3 - 5</u>	<u>6 - 17</u>	<u>18 - 34</u>	<u>35 - 54</u>	<u>55 & Over</u>
Total in group	34	47	250	232	254	153
Hot beverages	0.14	0.09	0.19	0.65	0.89	0.96
Cold beverages	0.47	0.77	0.95	0.73	0.66	0.61
TOTAL	0.61	0.86	1.14	1.38	1.55	1.57

XVI AVERAGE VOLUME OF TAPWATER CONSUMED AMONG HOT AND COLD BEVERAGES: by age, by sex, combined seasons (L/capita.day)

	<u>Under 3</u>		<u>3 - 5</u>		<u>6 - 17</u>		<u>18 - 34</u>		<u>35 - 54</u>		<u>55 & Over</u>	
	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>
Total in group	20	14	26	21	125	125	126	106	132	122	74	79
Hot beverages	0.14	0.14	0.08	0.10	0.22	0.16	0.69	0.59	0.96	0.82	0.98	0.94
Cold beverages	0.54	0.35	0.77	0.79	0.78	1.11	0.64	0.84	0.66	0.65	0.57	0.65
TOTAL	0.68	0.49	0.85	0.89	1.00	1.27	1.33	1.43	1.62	1.47	1.55	1.59

XVII USE OF HOT TAPWATER FOR MAKING HOT BEVERAGES: by household
(homemaker's custom), both seasons

	<u>Households</u>	<u>Percentage</u>
Often	40	13.6
Sometimes	56	19.0
Seldom	28	12.9
Never	160	54.2
Not stated	1	0.3
TOTAL	295	100.0

XVIII DISTRIBUTION OF PIPING MATERIAL AMONG HOUSEHOLDS

	<u>Percentage of Sample</u>	<u>Number of Households</u>
Copper	79.0	233
Lead	3.1	9
Galvanized	9.8	29
Plastic	6.4	19
Other	1.7	5
TOTAL	100.0	295

XIX AVERAGE DAILY TAPWATER CONSUMPTION IN RELATION TO COMMUNITY SIZE: all ages, both sexes, combined seasons (L/capita.day)

<u>Community Size</u>	<u>Number of People</u>	<u>Combined Seasons</u>
Over 500,000	303	1.23
100,000 to 500,000	174	1.39
30,000 to 100,000	82	1.48
10,000 to 30,000	55	1.45
Under 10,000	104	1.32
Rural	252	1.38
TOTAL	970	1.34

XX AVERAGE DAILY TAPWATER CONSUMPTION BY SOURCE OF WATER SUPPLY: all ages, both sexes, combined seasons

<u>Source</u>	<u>Consumption L/capita.day</u>	<u>Percentage of Sample</u>
Municipal	1.37	73
Well	1.30	14
Lake	1.01	2
Other	1.42	2
Did not specify	1.14	9

XXI AVERAGE DAILY TAPWATER CONSUMPTION BY SATISFACTION WITH WATER
SUPPLY: combined seasons

	<u>Consumption</u> <u>L/Capita.day</u>	<u>Number of</u> <u>Respondents</u>
Completely satisfied	1.38	446
Very satisfied	1.39	146
Neutral	1.21	242
Not very satisfied	1.44	76
Not at all satisfied	1.35	60

XXII PERCENTAGE OF DAILY TAPWATER CONSUMPTION TAKEN IN "RAW FORM"
BY SATISFACTION WITH WATER SUPPLY: summer*

	<u>Percentage of Water</u> <u>Consumed in "Raw Form"</u>
Completely satisfied	30.3
Fairly satisfied	29.9
Neutral	32.2
Not very satisfied	27.9
Not at all satisfied	20.2
Not stated	19.5

* data for winter not available

XXIII PERCENTAGE OF HOUSEHOLDS HAVING WATER SOFTENERS AND/OR WATER PURIFIERS:
by region

	<u>All Regions</u>	<u>Maritimes</u>	<u>Quebec</u>	<u>Ontario</u>	<u>Prairies</u>	<u>B.C.</u>
Number of households	295	28	91	107	45	24
Water softeners	8.5	7.1	2.2	9.3	24.4	None
Water purifiers	3.7	3.6	1.1	3.7	6.7	8.3

XXIV USE OF WATER SOFTENERS AND PURIFIERS NATIONWIDE

<u>Water Softeners</u> (8.5% of households)	<u>%</u>
Hotwater supply only	24
Hot and cold water supply	68
Not stated	8
<u>Water Purifiers</u> (3.7% of households)	
Permanently installed	55
Non-permanent	9
Not stated	36

C9 I H W 11 82 E 88
Canada. Dept. of Health &
Welfare.
82-ETH-80
Tap water consumption
in Canada

RESOURCE CENTRE
INST. FOR ENVIRON'L STUDIES
UNIVERSITY OF TORONTO



